ADBInstitute

Fintech for Asian SMEs

Edited by Naoko Nemoto and Naoyuki Yoshino

ASIAN DEVELOPMENT BANK INSTITUTE

ADBInstitute

Fintech for Asian SMEs

Edited by Naoko Nemoto and Naoyuki Yoshino

ASIAN DEVELOPMENT BANK INSTITUTE

ISBN 978-4-89974-109-1 (Print)
ISBN 978-4-89974-110-7 (PDF)

Note: In this publication, "$" refers to US dollars.

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5, Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan
www.adbi.org

Contents

Tables, Figures, and Boxes

TABLES

FIGURES

BOXES

Message from

SURAPOL OPASATIEN
Chief Executive Officer
National Credit Bureau Co., Ltd., Thailand

In "How Digital Innovation Can Help Small and Medium-sized Enterprise (SME) Access to Finance in Asia" Conference, 29 October 2018

We are now in the digital era. Banks are making more non-face-to-face banking transactions. Ten or twenty years ago, we know that the organizations in the business ecosystem were banks and/or lenders, consumers and/or small and medium-sized enterprises (SMEs), e-commerce merchants, or credit reporting agencies; and the ecosystem was not complex. But today, the ecosystem is changing. There are more organizations involve in the ecosystem and information from social media becomes more important. Lenders such as peer-to-peer (P2P) lenders can offer loans to their customers without using data from credit bureaus; and every process can be done easily and quickly through mobile devices.

In Thailand, the Bank of Thailand (BOT) has supported P2P lenders as the BOT will announce the guideline for startup companies who would like to build P2P lending platform. Nowadays, people create data everyday and everywhere in the form of physical data, transaction data, or location data. Technology companies or platforms that would like to enter the financial service market, or we can call it TechFin company, will benefit from its extensive data.

In the past, we used to say "no land, no loan" as we used collateral-based lending. After the financial crisis in 1997, we have used risk-based lending. Information from credit bureaus was very important. However, some SMEs and MSMEs or startup companies could not access loans through this lending schemes. So, the BOT announced the policy guideline that the borrowers' risk derived from financial data, behavior, and social information or information-based lending should be the next step to solve this pain point of SMEs from now on.

Last, some people used to say that "data are the new oil." But today some people say data are not the new oil anymore, it is the air. Therefore, we should learn, change, and utilize the data that we have to efficiently run businesses in this digital era.

Abbreviations

ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AI	Artificial Intelligence
AIC	Akaike Information Criterion
AISP	Account Information Service Provider
AML	Anti-Money Laundering
API	Application Programming Interface
AR	Accuracy Ratio
ASEAN	Association of Southeast Asian Nations
ATM	Automated Teller Machine
B2B	Business-to-Business
BAHTNET	Bank of Thailand Automated High-Value Transfer Network
BI	Central Bank of Indonesia
BPR	Business Process Re-engineering
CBRC	China Banking Regulatory Commission
CBS	Core Banking System
CEO	Chief Executive Officer
CFT	Combating the Financing of Terrorism
CGC	Credit Guarantee Corporations
CMA	Competition and Markets Authority (UK)
CRD	SME Credit Risk Information Database
CRD	Credit Risk Database
CRDS	Credit Risk Database for Startups
DAG	Directed Acyclic Graph
DBD	Department of Business Development
DFA	Digital Field Application
DFS	Digital Financial Services
DI	Dynamic Indicators
DLT	Distributed Ledger Technology

DOPA	Department of Provincial Administration
EAT	Earning After Tax
EBA	European Banking Authority
EBIT	Earnings before Interest and Taxes
EBITDA	Earnings before Interest, Tax Depreciation, and Ammotization
E-commerce	Electronic commerce or Internet commerce
EDC	Electronic Data Capture
ELECTRE	ELimination Et Choix Traduisant la REalité (ELimination and Choice Expressing REality)
ELECTRE TRI	ELECTRE Tree
ETDA	Electronic Transactions Development Agency
EU	European Union
FCA	Financial Conduct Authority
FI	Financial Institution
Fintech	Financial Technology
FSA	Financial Service Agency
FSP	Financial Service Provider
GDP	Gross Domestic Product
GNI	Gross National Income
GVA	Gross Value Added
HIT	Hometown Investment Trust
IoT	Internet of Things
IPO	Initial Public Offerings
ISA	Individual Savings Accounts
ITDC	Indonesia Tourism Development Cooperation
KYC	Know Your Customer
LGD	Loss Given at Default
LIPI	Indonesian Institute of Sciences
METI	The Ministry of Economy, Trade and Industry (Japan)
MICT	Ministry of Information and Communication Technology
MIS	Management Information System (CBS and other integrated systems)
MNO	Mobile Network Operator

mPOS	mobile Point of Sales
MRI	Magnetic Resonance Imaging
MSME	Micro, Small, and Medium Entrepreneur
MSME	Micro, Small, and Medium Enterprises
NBTC	National Broadcasting and Telecommunications Commission
NPL	On-Performing Loan
NPM	Net Profit Margin
NTB	Nusa Tenggara Barat (province of Indonesia)
OECD	Organization for Economic Cooperation and Development
OJK	Indonesia Financial Services Authority
OLS	Ordinary Least Squares
OSMEP	Office of SMEs Promotion
OTP	One Time Protection
OTP	One Time Password
P2P	Peer-to-Peer
PADG	Regulation of the Board of Governors
PBOC	People's Bank of China
PC	Personal Computer
PCA	Principal Component Analysis
PD	Probability of Default
PDCA	Plan Do Check Act or Plan Do Check Adjust
PFI	Preferred Infrastructure
PKH	Program Keluarga Harapan (Indonesian conditional cash transfer program)
POS	Point of Sale
PRC	People's Republic of China
PSD2	Payment Service Directive Revised
PSP	Payment Service Provider
QR code	Quick Response code
RD	Revenue Department
RDB	Risk Data Bank of Japan, Limited
RTGS	Real-Time Gross Settlement

SEC	Securities and Exchange Commission
SFI	Specialized Financial Institution
SLA	Service Level Agreement
SMAA	Stochastic Multicriteria Acceptability Analysis
SME	Small and Medium-sized Enterprise
SMESS	Small Medium Enterprise Sale System
SMS	Short Message Service
TCG	Thai Credit Guarantee Corporation
TekFin	Teknologi Finansial (Indonesian)
US	United States
USSD	Unstructured Supplementary Service Data
VAS	Value-Added Services
VC	Venture Capital
YTD	Year to Date

Preface

Small and medium-sized enterprises (SMEs) play a vital role as a driving force in economies around the world, especially in developing and emerging markets. SMEs in the Association of Southeast Asian Nations (ASEAN) region are estimated to comprise more than 98% of the total number of enterprises, and they contribute to around 40% of gross domestic product. In order to enhance productivity and ensure sustainable growth in Asia, providing smooth financing for SMEs is of critical importance.

While loan volumes to individual SMEs are relatively small, SMEs tend to have less disclosed information. Therefore, traditionally, commercial banks have regarded loans to SMEs as risky, and they have tended to offer higher interest rates because of the lack of sufficient collateral due to SMEs' limited liquidity. However, new technologies, including distributed ledger technology, cloud computing, and artificial intelligence, have started to enable faster, more convenient, and most cost-effective financial services. The digital innovation is paving the way for SMEs to have access to better financial services.

Accumulated digital data can complement the limited data disclosed by SMEs and reduce the cost of information asymmetries. In 2014, the National Credit Bureau (NCB) and I started analyzing banks' lending records in Thailand to propose a new credit rating scheme. The project aimed to contribute to filling the vast credit gaps in SME lending through the effective use of the NCB's limited but reliable data on SMEs. Subsequently, rapid technological developments dramatically increased the available data sources and now provide various parties with the opportunities to leverage the data in their activities. For instance, the Secretary of Finance in the Philippines plans to leverage satellite data to estimate underreported SMEs' revenue and collect tax fairly. As an example, any underreporting of income by family-run restaurants can be readily detected by using satellite data on visitors together with the average spending per customer. The sales of smallholder farmers can also be reasonably estimated by monitoring the growth of crops and the number of trucks entering and leaving fields. Furthermore, new technology and big data can also be employed to reduce the cost of information asymmetry between the financial sector and SMEs. Technology advancement improves the efficiency of financial institutions, including fintech firms, by encouraging competition, and it further enables SMEs to achieve more favorable terms for their financing.

Meanwhile, growing opportunities are also encouraging governments and international societies to develop regulatory frameworks, especially for start-up businesses. Traditionally, the lending and monitoring criteria of financial institutions for SME loans depended heavily on the judgements of experienced bankers. However, ample and timely information made available by new technology and big data now allow inexperienced individuals to make investment decisions. Crowdfunding, peer-to-peer (P2P) lending, and other new tools can support start-up finance, but they carry unique and inherent risks. Investors are at risk of losing their invested funds, and SMEs relying on such funding face the possibility of capital suddenly drying up or becoming more expensive in the future. Fraud, information leakages, and cyberattacks are additional concerns. The challenge for regulators is to protect investors and maintain financial stability while simultaneously maintaining an innovative market by harmonizing fair law enforcement, making appropriate interventions in the economy, and fostering technology advancement. The development of a sensible regulatory framework is crucial as the foundation of a vibrant and trustworthy business environment.

The rapid development of fintech is increasing the need for financial education. Although fintech lowers the barriers to financing and investment, the fundamental risks and organizational limitations remain. Therefore, SMEs need to improve their financial literacy to take the most advantage of the financial opportunities made possible by fintech. Also, SMEs themselves can use fintech as a tool for analyzing their own businesses and improving performance. In this rapidly changing business environment, SMEs are required to actively respond to transformation without getting swept away by the trend.

The purpose of this book is to identify and develop ideas on how to utilize new technology in SME finance. Effective utilization should encourage financial institutions and investors to further develop credit risk analysis, increase financing, and contribute to the sustainable growth of SME sectors. Further, this book will explore ways in which policymakers and market participants can maximize the benefits of and mitigate the potential risks arising from the new digital era. The content of the book is based on the research presented at the conference, "How Digital Innovation Can Help Small and Medium-sized Enterprise (SME) Access to Finance in Asia," organized by the Asian Development Bank Institute and the NCB in October 2018.

The first three chapters focus on the financial accessibility of SMEs using emerging financial technologies. Chapter 1 overviews the SME credit gap in Asia and assesses ways for SMEs to improve their access to financial services. It further discusses the ways to boost long-term economic growth using emerging technologies and

innovative business models. Chapter 2 discusses open banking and explains its application in supporting SMEs. It introduces the key concept of open application programming interfaces and their role in connecting banking systems to a larger ecosystem in comparison with traditional financial institutions. The chapter further discusses novel-use cases and examples and deliberates on the risks associated with open banking. Chapter 3 sheds light on the practical solutions for filling the financing gap in risky businesses and start-ups. It discusses the application of distributed ledger technologies for hometown investment trust fund schemes by incorporating an information infrastructure, and a credit risk database for start-ups in order to create a more sustainable regional fund management framework by increasing the attractiveness for investors.

Chapters 4 and 5 propose ways to harness the data generated by bank accounts to reduce time and costs for the realization of more efficient SME finance. Chapter 4 introduces new dynamic monitoring indicators based on the information generated by bank accounts and illustrates the benefits of timely and structural credit risk profiling. It also provides an application of the indicators for the planning and implementation of sound economic restoration from the damages caused by wide-ranging disasters. Chapter 5 discusses the potential of the utilization of bank account information based on empirical analyses of Japanese data. The analyses demonstrate that the accuracy of default predictions improves, especially for SMEs, when the model incorporates bank account information in addition to traditional financial information.

In addition to the traditional lending by commercial banks, Chapter 6 describes and evaluates P2P lending for SMEs in various countries considering their different systems and regulatory regimes. More specifically, it carefully reviews the latest regulatory frameworks of the United States, the United Kingdom, the People's Republic of China, and Japan. It also suggests an effective regulation model for the risk management of loans.

Chapters 7 and 8 examine the impact of fintech on SMEs in Asian countries. Chapter 7 presents an empirical study conducted for a broad range of industries in Thailand. The study claims that the internet and mobile banking provide substantial support for SMEs in improving their business performance and increase the likelihood of them continuing their business. Chapter 8 shows that even in cash-dominant regions in Indonesia, the introduction of digital payments is beneficial for the development of SMEs.

Chapter 9 focuses on bank evaluation and introduces an index to measure banks' capability to nurture and develop corporate clients. In particular, the indicator assesses the value of consultations and support provided by banks to client firms regarding restructuring or enhancing of their performance drawing from business relationships fostered over time.

I hope that this book will contribute to achieving stable, affordable, and long-term financing for SMEs in the Asian region as well as increasing the management capability of financial information security for financial service providers and other parties.

Yoshino Naoyuki
Dean, Asian Development Bank Institute

CHAPTER 1

How Digital Innovation Can Increase Small Business Access to Finance in Asia

SEAN CREEHAN
Federal Reserve Bank of San Francisco*

Small and medium-sized enterprises (SMEs) are a key contributor to economic activity around the world as an important source of jobs, growth, and innovation.[1] Despite their essential role, SMEs receive a disproportionately small share of credit from the financial system, a trend that persists across developed and developing countries, including in Asia (ADB 2015a). This chapter summarizes the SME credit gap in Asia and assesses ways emerging technologies and innovative business models—commonly known as "fintech"[2]—can improve SME access to financial services in Asia and boost long-term economic growth in the process.

1.1 Asia's SME Credit Gap Is Particularly Large

SMEs are crucial to Asia's economic vitality. They represent 42% of Asia's gross domestic product and are responsible for well over half of all jobs (see Table 1.1).[3] In addition, research on SMEs highlights their important role in innovation, with a significant minority of highly innovative firms matching the profile of start-ups typically associated with places like Silicon Valley. Despite their important role, a significant mismatch exists between SMEs' economic impact and their access to

1 The definition of small and medium-sized enterprises (SMEs) varies by country and according to indicators like head count or key financials. It typically applies to firms of 200–250 employees or fewer across developed and developing countries. In developing Asia, firms of asset sizes roughly $5 million and below are typically considered SMEs, though this can also vary by industry type. Revenue-based definitions tend to vary more widely by country, as firms with revenues exceeding $50 million might still be considered SMEs in the People's Republic of China, while the threshold is below $5 million in countries like Indonesia or Viet Nam. See Vandenberg, Chantapacdepong, and Yoshino (2016).

2 This chapter defines "fintech" broadly as the use of new technology or innovative business models in the delivery of financial services by both traditional, regulated firms and emerging start-ups.

3 2014 estimate (ADB 2015b).

finance—Asian SMEs receive just 18.7% of total bank credit.[4] With nearly 1 million new jobs needed each month to absorb Asia's growing workforce, expanding access to credit for SMEs is a pressing policy priority (World Bank 2012).

Table 1.1: Small Businesses Play a Large Role in Asian Economies

Economy	SME Share of Employment (%)	SME Contribution to GDP (%)	Data Year
China, People's Republic of	64.7	60.0	2011, 2013
Hong Kong, China	47.0	–	2012
India	40.0	37.5	2015, 2013
Indonesia	97.0	60.3	2009, 2013
Japan	69.7	43.7	2012
Korea, Republic of	87.7	47.6	2012
Malaysia	65.0	35.9	2014
Philippines	63.7	35.7	2013, 2009
Singapore	68.0	45.0	2012
Taipei,China	78.0	30.0	2011
Thailand	80.3	39.6	2014
Viet Nam	46.8	40.0	2012, 2011

GDP = gross domestic product, SMEs = small and medium-sized enterprises.

Sources: Shinozaki (2012), APEC Policy Support Unit (2013), Yoshino and Wignaraja (2015).

A joint study by the Organisation for Economic Co-operation and Development (OECD) and the Asian Development Bank (ADB) found that SMEs in Asia lag behind global peers in access to financial services, specifically credit. Notably, Asian SMEs are less likely than global peers to have made recent investments, and more likely to have relied on retained earnings over external financing if they did so. The direction of causality between Asian SMEs' investment and borrowing behavior is not easily determined, but Asian SMEs are roughly half as likely to apply for loans as global peers according to OECD–ADB surveys.[5] Their reluctance to borrow may be due to stricter bank requirements: they are roughly 50% more likely to be required to provide collateral in borrowing.[6]

4 2014 estimate.

5 21.2% of Asian SMEs are likely to apply for a loan compared with 38.2% of their global peers (ADB 2014a).

6 74.4% for Asian SMEs compared with 51.1% for global peers.

Why the Credit Gap Exists

Providing financial services to SMEs generally involves greater costs and higher risks compared with serving other types of enterprises. Small businesses have fewer assets to use for collateral, less stable sources of revenue, and limited liquidity—factors that increase credit risk. From a cost perspective, providing a commercial loan involves significant operational costs prior to loan origination, such as customer acquisition, due diligence, regulatory compliance, credit risk analysis, and document processing. Loan servicing, particularly for higher-risk customers like SMEs, brings additional costs. Because SMEs typically borrow small amounts of money, lenders may find such loans less profitable, even if they charge higher interest to account for greater credit risk. Instead, banks and other financial institutions generally rely on economies of scale to lend efficiently, directing credit to larger customers.

This problem is compounded by so-called "thin file" customers with limited to no-credit histories. By nature, many SMEs have never received funding from the formal financial system, either because of their early speculative stage (when they may rely on money from the entrepreneur's savings or personal network) or limited collateral to back bank loans. Many developing countries lack robust credit rating systems and even firms with some credit history may not qualify for loans. The limited availability of traditional data for credit risk assessment impacts banks' lending decisions, driving higher interest rates for SMEs or limiting financing outright.

1.2 Asia's Digitizing Economy: Can Leveraging Technology Fill the Gap?

Emerging financial technology and innovations in traditional business models can take advantage of Asia's rapidly digitizing economy to expand SMEs' access to credit in Asia through several complementary improvements. The use of alternative data can enhance credit analysis of small businesses previously disadvantaged by limited credit history, a problem in Asian countries without comprehensive credit bureau coverage. Technology-driven changes to business models can also expand access to financial services with growth potential for Asia's SMEs: trade finance, by modernizing inefficient processes and reducing the role of costly intermediaries, and invoice financing, by leveraging the digitization of commerce to make accounts receivables more easily priced and traded.

Even in a conservative scenario, innovation in SME financing can unlock liquidity and working capital that allows SMEs to survive the volatile early stages of growth and development. Having greater access to finance might also create a benevolent cycle as access helps build credit history that financial institutions can use to better price SME loans, amplifying the benefits and supporting long-term economic growth (ADB 2014b). Some of these improvements would undoubtedly be disruptive to incumbents. Still, while new SME-focused fintech firms might take some market share from traditional firms, they are most likely to serve many borrowers that traditional firms currently reject. Market share lost to newcomers will likely be offset by an increase in the overall size of the market.[7]

Using Alternative Data to Expand Credit Scoring

In most of Asia, credit scoring is still limited despite many countries' efforts to develop national credit bureaus over the past several decades (Kwan 2011). In the People's Republic of China (PRC), for example, an estimated two-thirds of people were not scored by a credit bureau as recently as 2015 (Sheng, Yip, and Cheng 2017), while in India, 80% of people lacked coverage according to 2014 Reserve Bank of India surveys (RBI 2014). Limits to such credit scoring of individual borrowers typically extend to small businesses, particularly those established by individual proprietors. Without prior credit history, small business owners find it more difficult to qualify for loans and access other financial products.

The increasing availability of online data is changing the landscape. Several innovative Asian firms are leveraging alternative data generated by the growing level of social and economic activity taking place online to help fill this credit scoring gap. Asia represents a natural place for such innovation, given the region's growing share of e-commerce. In 2016, the PRC became the world leader in e-commerce with sales of nearly $400 billion, according to data from Euromonitor. Other countries like Japan, the Republic of Korea, and India are among the top 10 (The Economist 2017). Meanwhile, Asia was the home to an estimated $6 trillion in business-to-business (B2B) e-commerce sales in 2017, roughly three-quarters of the global total (Statista 2017).

[7] For example, ADB estimates that at least 36% of rejected financing for SMEs engaged in trade could be fundable by other financial institutions. See Di Caprio, Kim, and Beck (2017).

A lender may analyze an SME borrower's online sales and payments activity to assess the borrower's ability to repay a loan without a credit score or use utilities and telecommunications company data to confirm if a borrower has a history of paying bills on time. A lender can also use various data to corroborate basic elements of a loan application more quickly and cheaply, such as verifying a small business' place of operations through geolocation data obtained from the entrepreneur's telecommunications company. One start-up, Tala Mobile, is experimenting in India with a variety of social data shared by borrowers that use its mobile app—the company claims that indicators as basic as how frequently someone calls a loved one can help inform a credit decision.

Among Asian countries, the Government of the PRC sees clear potential for the use of alternative data. In 2015, the People's Bank of China (PBOC) issued provisional licenses to eight firms—including leading fintech firms associated with Alibaba, Tencent, and Ping An—to establish credit scoring services that leverage such alternative data to increase access. The firms have continued to operate despite the expiration of these provisional licenses, with Alibaba's Sesame Score serving 260 million users as of July 2017 (ADB 2015a; Morgan Stanley 2015). The PBOC has reportedly expressed some concern that credit scores across firms are inconsistent, and more likely to be correlated to a customer's use of a given commercial platform (e.g., Alibaba's retail products or Tencent's social media networks) than actual creditworthiness (Chorzempa 2018). In February 2018, the PBOC approved the PRC's first personal credit platform, Baihang Credit Scoring, which was jointly founded by eight credit firms including Tencent Credit and Sesame Credit. The National Internet Finance Association of China is Baihang's largest shareholder with a 36% stake. Such a national-level consolidation will likely assure a uniform methodology for credit scoring that includes nonfinancial data while also preventing the emergence of closed, proprietary credit scoring systems that do not share data within the financial system.

The increasing availability of data on SME borrowers could also be used in national-level credit databases that do not contain individual ratings but instead generalize credit risk for various SME borrower types. Japan's Credit Risk Database, established in 2001, is a potential model for emerging uses of alternative data in SME credit analysis. Its members voluntarily share anonymized financial data on SME borrowers' financial history to help the broader system better assess credit risk (Kuwahara et al. 2015). Similarly, the traditional and start-up firms using new sources of data to track SME credit risk in places like the PRC could share information to improve overall credit analysis. Both public and private sector efforts could compel such information sharing. The benefits could include more precise estimates of default risk

and a resulting decline in SME risk premiums. Improving accuracy of SME credit risk assessments could also affect regulatory views of the riskiness of the sector should enhanced data analysis reveal significant bias in the measurement of SME credit risk not previously recognized by analysts. This could lead to further improvements in SME financial access if, for example, regulators reduced capital risk weightings for SME loans over time if SME loans showed sustained performance improvements. Public credit guarantee programs could also use new forms of data to expand their coverage (Box 1.1).

Box 1.1: Enhancing Credit Guarantee Programs

Efforts to share and aggregate alternative data could also enhance existing credit guarantee programs, which have historically been a favored policy tool of governments hoping to stimulate small business lending. The Republic of Korea is one of the most successful examples of credit guarantee in Asia. Loans of small and medium-sized enterprises (SMEs) represent nearly 40% of the country's gross domestic product (GDP) as of the International Finance Corporation's Financial Access Survey in 2012. These loans are largely supported by the Korean government through its Credit Guarantee Agency, and government credit guarantees of SME loans exceeded 4% of GDP as of 2014, the third-highest measure among countries of the Organisation for Economic Co-operation and Development (OECD). Credit guarantees make private financial institutions more willing to lend, although moral hazard may undermine due diligence practices. Indeed, most successful credit guarantee programs make sure that private lenders retain significant risk on their own balance sheets while also assuring the guarantees are only paid out after adequate efforts are made to recover and resolve bad debts.

The creation of national credit databases that include both financial and alternative data might improve the effectiveness of existing credit guarantee programs or stimulate new initiatives. In countries where private firms are slow to adopt alternative data to expand SME lending, public sector entities could increase lending through technology-enhanced credit guarantee programs.

Sources: Ardic, Imboden, and Latortue (2012); Bell (2016).

Despite the potential benefits of credit scoring, the rising use of alternative data raises several potential legal and regulatory concerns. Perhaps most prominently, regulators worry that the use of algorithms could create discriminatory outcomes in lending decisions, biasing credit allocation away from disadvantaged groups. Further, while users may consent to the broad use of data generated by mobile phone activity, for example, privacy protection may limit use. In India where policy makers

have promoted a national biometric identification system that has potential uses across the financial system, courts are weighing the social and economic benefits of such a system against an individual's right to privacy. More broadly, the creation of a digital financial identity raises questions about an individual's right to understand how personal data can drive credit scores, their ability to share data generated on proprietary platforms, and their recourse to challenge or correct scoring should it be based on inaccurate information. These are all active issues that Asian policy makers and regulators will confront as a broader array of social and economic data impacts their citizens' financial lives.

Modernizing Trade Finance with Distributed Ledgers

The growing importance of Asia in world trade makes expanded access to trade finance a potential game changer for its small businesses, which contribute over 40% of exports of major economies like the PRC and India (Table 1.2). The region is now responsible for roughly one-third of global trade, lagging behind only Europe, while Asian firms already account for roughly half of the world's supply chain exports, which involve trade in parts and components (WTO 2016).[8] Further economic growth combined with potential for progress in regional trade deals makes Asia likely to become the largest contributor to overall trade soon.

Table 1.2: Small Businesses' Contribution to Exports in Select Economies

Country	SME Share of Exports (%)	Data Year
China, People's Republic of	41.5	2011
India	42.4	2013
Indonesia	15.7	2013
Korea, Republic of	18.8	2012
Thailand	26.3	2014

SME = small and medium-sized enterprise.

Source: Shinozaki (2012).

[8] Supply chain exports data. See Yoshino and Wignaraja (2015).

Despite SMEs' existing participation in Asia's trade, their presence is restricted by access to finance. Surveys of SMEs report limited funding as a common reason they refrain from trade in the global supply chain. ADB estimates that firms in Asia face an annual trade financing gap of $600 billion, with roughly one-quarter, or $150 billion, of the gap faced by SMEs (mid-cap firms represent another $300 billion) (Di Caprio, Kim, and Beck 2017). Among firms rejected for trade finance, 60% said they did not proceed with the trade because of lack of finance.[9] ADB estimates that a 10% increase in trade finance is associated with a 1% increase in employment.

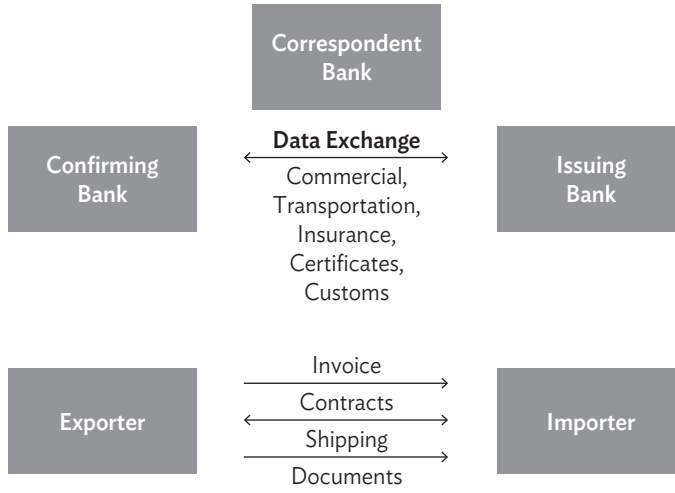
Trade finance remains a highly old-fashioned business, with a preponderance of paper-based processes and a complicated chain of intermediaries in between buyers and sellers of goods. These parties coordinate transactions across several axes, including languages, currencies, accounting systems, customs regimes, laws, and regulations. A common trade finance transaction, represented in Figure 1.1, may involve extensive paperwork across multiple ledgers, due diligence and compliance processes, and three financial institutions, not to mention third parties involved in verifying progress of goods through various stages in the transaction.[10] Further, a typical transaction is arguably more complex in Asia than other major trading regions like Europe, where business takes place across more developed economies, under a common currency, and within a free trade union with many harmonized laws, regulations, and commercial standards. As with other forms of lending to SMEs, the more inefficient a process, the less likely it can sustain the service of smaller customers, but also the greater the opportunity for innovation.

Asia's existing inefficiencies in trade finance may particularly benefit from the use of blockchains, also known as distributed ledger technology, one of the most-hyped new financial technologies to emerge in recent years. Traditionally, banks have served as a trusted intermediary between importers and exporters by providing assurance that goods will be delivered, and bills paid, assuming each party complies with various commercial terms. Still, the complex sequence of steps in international trade means a range of documentation—often in paper form—must be tracked across multiple ledgers, with several other third parties required for verification and coordination with banks. This tends to add time and cost to transactions while also increasing the risk of documentation errors.

[9] Includes firms across all countries surveyed by ADB.

[10] Trade finance is like factoring in that a commercial transaction depends on bridge financing to proceed. With trade finance, financial intermediaries help assure payments that cross borders and change currencies, mitigating risks inherent in international trade. With factoring, the intermediary is helping accelerate payment, not mitigating risk that the buyer may not pay.

Figure 1.1: Typical Information Exchanges in Trade Finance Transactions



Sources: Author's illustration; Dab et al. (2016).

By providing a single mechanism for tracking various steps in the trade finance process—orders, contracts, documentation, insurance, multimodal shipments, customs, delivery—a blockchain could enhance interoperability among previously incompatible systems, improve accuracy and eliminate redundancy in record keeping, reduce end-to-end transaction time, and increase transparency. For example, a blockchain letter of credit could be scheduled to execute upon delivery of goods to the port of entry. In the past, the good's arrival may have required verification, which itself could be held up by other customs approvals. By embedding the contract with a geolocation trigger, the letter of credit could execute immediately upon the good's arrival in port or clearance through customs. Barclays claims to have issued the first blockchain-based letter of credit in 2016, executing a transaction that normally takes up to 10 days in under 4 hours (Kelly 2016). With the power of such innovation in mind, the Hong Kong Monetary Authority and Monetary Authority of Singapore are each developing distributed ledger technologies in collaboration with major banks, with plans to link the systems eventually (Barreto 2017).

The use of blockchain in foreign currency transactions also can potentially reduce the role of correspondent banks that add time and cost to trade finance transactions.

Traditionally, if an exporter's local bank has no access to international financial markets, it will seek a correspondent bank that can provide cross-border services, linking the customer to another country's financial system. While cross-border payments using traditional correspondent banking networks visualized above can take a full business week, new blockchain networks may allow banks to establish bilateral relationships for quicker transfers and at lower cost (Higginson 2016). Notably, the initial use of such technology has typically involved the collaboration between fintech start-ups deploying the technology for traditional institutions. This new competition has even spurred on the Society for Worldwide International Financial Telecommunication, commonly known as SWIFT, which has traditionally served a central role in international correspondent banking. SWIFT is now experimenting with blockchain to increase the speed and transparency of its own services.

Technology driving change in other financial services can also make a difference for SMEs rejected for trade financing because of low profitability or limited information on its own bona fides or that of its counterparty. More granular analysis of SMEs' financial profiles (for example, using alternative data analysis envisioned earlier) could provide insight into a borrower's profitability. In parallel, ubiquitous tools to conduct digital "Know Your Customer" (KYC) compliance could reduce the time and cost of such due diligence for financial providers and make it easier to verify the bona fides of a customer's counterparty (Box 1.2).

Box 1.2: Automation Makes Lending to Small Firms Viable

Automation of previously labor-intensive tasks like contracting and compliance can make lower value loans to small and medium-sized enterprises more viable. To some extent, the use of technology to automate basic functions is ubiquitous across the economy; any rational business owner uses technology to enhance productivity and lower costs. Still, some emerging technology is well suited to automate specialized legal finance tasks previously considered the realm of high-skilled labor, while the digitization of economic activity can reduce the cost of previously labor-intensive compliance functions. Automated legal functions can reduce the time and budget required to process new loan paperwork and draft loan agreements, making smaller-value loans profitable. The use of machine learning has reduced legal costs for JP Morgan, for example, automating what previously required 360,000 hours of annual work by lawyers and loan officers. New digital "Know Your Customer" compliance systems can take advantage of increasingly robust national databases promoted in countries like Singapore, Thailand, and India to reduce the time and cost of small customer acquisition and due diligence.

Source: Son (2017).

Even assuming the persistence of cumbersome paper processes and handwritten data inputs at certain stages of the process, the use of optical character recognition combined with machine learning could drastically improve operational efficiencies and lower costs (Dab et al. 2016).

With continued growth in regional trade, the need to finance SMEs in the trade sector will only increase in the years to come. Altogether, innovations that improve the efficiency of trade finance transactions could open the sector to SMEs that have long been underserved.

Leveraging Online Commerce to Expand Invoice Financing

The rapid digitization of commerce in Asia also has the potential to expand the role of invoice financing—also known as factoring—for the region's SMEs. Factoring is one of the oldest forms of lending: financial institutions purchase invoices owed to a business, assuming the risk that a bill is not paid in return for a discount on the notional value of the invoice.[11] Factoring is particularly attractive to smaller firms that might otherwise lack collateral to obtain loans or face other liquidity constraints. These firms can rely on the creditworthiness of larger customers to facilitate borrowing for investment or, more typically, working capital. Factoring also lets SMEs make up for their limited expertise and bargaining power when collecting late payments from big customers by outsourcing these activities to a third party.

The Asia and Pacific region is already the second-largest factoring market in the world according to statistics from FCI, an industry trade association, representing less than one-quarter of the global total (Europe dominates at 67.1%). Given Asia's broader economic potential and substantial and growing online B2B market (three-quarters of the world total), the region is poised for further growth in factoring. As more and more Asian businesses conduct their activities digitally—for example, selling goods online or using accounting software—their accounts receivables become standardized documents more easily priced, financed, and traded by factoring firms.

[11] Supply chain finance, also known as reverse factoring, is similar in concept to traditional factoring but the buyer initiates the financing for the supplier, again backed by the buyer's creditworthiness in fulfilling the accounts receivable. Note that supply chain financing does not necessarily involve international trade finance, as discussed earlier.

As with trade finance, technology can offer several improvements to expand the factoring market to more SMEs. The use of blockchain contracts or centralized digital platforms could standardize the format of invoices, making them easier to verify, trade, and finance (Box 1.3). Several start-ups are already experimenting with the technology globally (see, for example, Wass 2017). Alternative data that supports credit analysis in other sectors (for example, the use of payments data discussed earlier) could also be used to assess the creditworthiness of SMEs' customers, allowing for more accurate analysis of the credit risk in funding the accounts receivables. Indeed, online retailers like Alibaba and Amazon already use such data in their own affiliates' lending activities.

Box 1.3: Blockchain Could Expand SMEs' Collateral for Borrowing

Blockchains may make it easier to attach movable assets like vehicles, machinery, and even inventory to a loan. Historically, such assets have frequently been disqualified because the borrower could not physically transfer them to the lender given their importance in business operations. Several Asian countries like the People's Republic of China (PRC) and Thailand have implemented legal frameworks to make it easier for borrowers and lenders to include movable assets as collateral, but technology could make the use of such assets more practical, improving credit access and affordability. Combined with geolocation technologies, SMEs could offer what limited assets they may have as collateral. A lender might more readily lend against the fleet of a small business's vehicles, for example, if it could more easily collect the collateral in the event of default. These techniques could also be used to reduce the risk and resulting cost of leasing equipment to small businesses.

SMEs = small and medium-sized enterprises.

Source: Vandenberg, Chantapacdepong, and Yoshino (2016).

Factoring could also leverage the rise of e-commerce platforms to bundle invoices and perhaps lengthen the term of lending. More accessible commercial data—for example, on the typical lag experienced in the settlement of invoices—provided over open application programming interfaces (APIs) could enable pooling of payment risk for a portfolio of bundled invoices from lesser-known buyers.[12] For a company with a sufficiently long transaction history on a platform, a longer-term loan based on projected future sales might even make sense, particularly if the lender negotiated a

[12] APIs establish standards, protocols, and tools that allow software programs to communicate and interact with each other. The increasing potential for such commercial data may also necessitate regulation of the customer's right to use this data across the financial system through APIs. In the absence of regulation, data monopolists might restrict use of data to their own financial partners.

right to secure interest and principal payments to borrower cash flows generated on the platform.[13] This might make factoring suitable not just for short-term liquidity and working capital (its typical use) but also a potential alternative source of investment capital. Bundling could also capture invoices owed by retail customers, broadening the base of tradable invoices beyond the business-to-business sector, traditionally the focus of factoring firms given their preference for larger, more creditworthy counterparties.

Such financing need not be restricted to sales generated online either. Square, a US fintech firm focused on payments, now offers loans to customers based on accounts receivables generated via the company's physical point-of-sale terminals. In theory, several retail platforms, whether online or physical, could enable SME borrowers to provide collateral for invoice financing through existing or even expected sales on the platform.[14]

The broader supply of tradable invoices and more granular insight into commercial relationships between businesses could also make factoring possible across multiple layers of a major buyer's supply chain. Factoring firms typically manage credit risk by purchasing the invoice owed by a known, creditworthy borrower, but technology could let buyer invoices finance more indirect supplier relationships in an SME cluster.[15] For example, a factoring firm might more willingly lend to a small supplier that provides inputs for a larger supplier if it knew both firms' revenues were supported by purchases of a large, creditworthy buyer upstream (Figure 1.2). This could create reinforcing network effects for the broader SME economy. By reducing the lag between production and payment, technology-enhanced factoring for SMEs could reduce financial stress and drive SME growth.

As with any form of finance, growing access can create risks. While invoice financing by nature transfers credit risk from the SMEs to their larger buyer, growth in this kind of credit may increase the risk of fraud and excess leverage. Technology should help reduce fraud through improved KYC verifications and the use of immutable digital contracts, but prudential regulation will also be required.

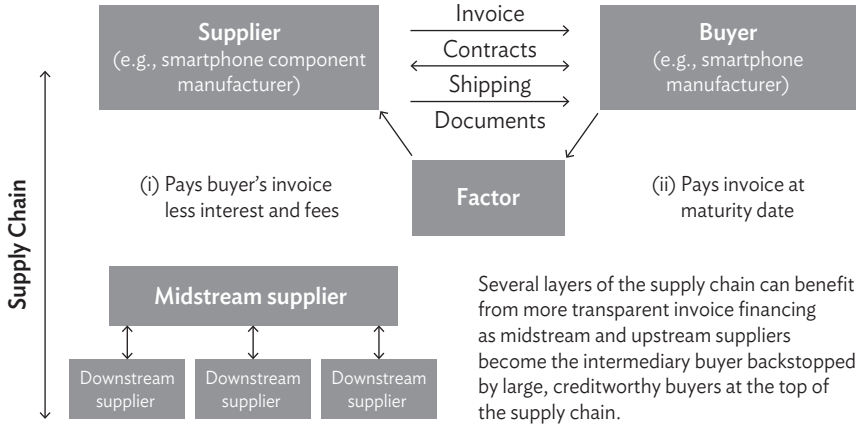
---

13 This invoice-based loan could be analogous to revenue bonds issued by municipal governments. Such bonds are guaranteed for repayment by specific revenue-generating activities of the government. Some businesses might shirk at the restrictions implied by such an arrangement, and laws and regulations would need to ensure adequate protection for small businesses to prevent large e-commerce platforms from restricting competition by offering such crosscutting services.

14 Firms like Square Capital typically cap a loan at the equivalent of a borrower's 1-month sales though, in theory, fintech firms could offer larger loans to borrowers with an extended history of robust sales growth.

15 An SME cluster represents a supply chain of complementary small businesses engaged in manufacturing, services, and sales. See Shinozaki (2012).

Figure 1.2: Broadening Invoice Finance



Source: Author's illustration.

1.3 A Potential Structural Shift in the Economic Impact of Asia's SMEs

Financial technology can potentially expand financial access for small businesses around the world, but several factors may make innovations particularly powerful for Asia's SMEs. The region's still-limited credit scoring begs for an alternative to traditional credit rating bureaus, while the increasing amount of economic and social activity taking place online in Asia provides potential data to bolster SMEs' limited financial history. Meanwhile, the region's rapidly growing, but still complicated, trade networks mean innovations in trade finance could have an outsized impact, important for the large number of SMEs involved in exports but without access to trade finance. Finally, Asia's already-substantial market for invoice financing, a key source of liquidity and capital for small businesses, can leverage the region's digitization of commerce, particularly the rapid rise of online B2B sales, to expand access.

If technological innovations combine to shrink Asia's SME credit gap, the economic impact of small businesses could increase substantially. Already a major source of economic activity, employment, and innovation, SMEs with increased access to working and investment capital will be healthier and more resilient. Particularly for younger start-ups, which are often the most innovative businesses, access to finance at an early stage of development could be the difference between bankruptcy and

survival. Given the interrelationships among SMEs in many economies, the network effect of increasing SME health could be significant, while improving the sector's financial access and resilience would also boost the entire economy's long-term growth potential.

References

APEC Policy Support Unit. 2013. SMEs in the APEC Region. APEC Policy Support Unit Policy Brief No. 8. December. http://publications.apec.org/Publications/2013/12/SMEs-in-the-APEC-Region (accessed 15 February 2018).

Ardic, O. P., K. Imboden, and A. Latortue. 2012. *Financial Access 2012*. Consultative Group to Assist the Poor and International Finance Corporation.

Asian Development Bank (ADB). 2014a. ADB–OECD Study on Enhancing Financial Accessibility for SMEs: Lessons from Recent Crises. Manila: ADB. https://www.oecd.org/cfe/smes/adb-oecd-study-enhancing-financial-accessibility-smes.pdf (accessed 15 February 2018).

———. 2014b. Low-Cost Loans to Small and Medium-Sized Companies in Asia. https://www.adb.org/features/low-cost-loans-small-and-medium-sized-companies-asia (accessed 15 February 2018).

———. 2015a. Let's Scale Up, Vary Access to SME Finance to Boost Asia's Growth, Cross-Border Trade. Asian Development Blog. 21 September. https://blogs.adb.org/blog/let-s-scale-vary-access-sme-finance-boost-asia-s-growth-cross-border-trade.

———. 2015b. Asia's SMEs Need Growth Capital to Become More Competitive. https://www.adb.org/news/asia-s-smes-need-growth-capital-become-more-competitive-adb-report (accessed 15 February 2018).

Barreto, E. 2017. Hong Kong, Singapore to Link Up Trade Finance Blockchain Platforms. *Reuters.* 24 October. https://www.reuters.com/article/us-hongkong-singapore-fintech/hong-kong-singapore-to-link-up-trade-finance-blockchain-platforms-idUSKBN1CU0JY (accessed 15 February 2018).

Bell, S. 2016. Learning from Korea: The Story of Korea's Credit Guarantee Agency. Washington, DC: World Bank. http://blogs.worldbank.org/psd/learning-korea-story-korea-s-credit-guarantee-agency (accessed 15 February 2018).

Chorzempa, M. 2018. China Needs Better Credit Data to Help Consumers. Peterson Institute for International Economics Policy Brief. https://piie.com/system/files/documents/pb18-1.pdf (accessed 15 February 2018).

Dab, S., S. Ramachandran, R. Chandna, R. Hanspal, A. Grealish, and M. Peeters. 2016. Digital Revolution in Trade Finance. 30 August. Boston Consulting Group. https://www.bcg.com/publications/2016/digital-revolution-trade-finance.aspx (accessed 15 February 2018).

Di Caprio, A., K. Kim, and S. Beck. 2017. 2017 Trade Finance Gaps, Growth, and Jobs Survey. ADB Briefs No. 83. September. https://www.adb.org/publications/2017-trade-finance-gaps-jobs-survey (accessed 15 February 2018).

The Economist. 2017. The New Bazaar: E-Commerce Takes off. 26 October. https://www.adb.org/publications/2017-trade-finance-gaps-jobs-survey (accessed 15 February 2018).

Higginson, M. 2016. How Blockchain Could Disrupt Cross-Border Payments. The Clearing House. https://www.theclearinghouse.org/banking-perspectives/2016/2016-q4-banking-perspectives/articles/blockchain-cross-border-payments (accessed 15 February 2018).

Kelly, J. 2016. Barclays says Conducts First Blockchain-based Trade-Finance Deal. *Reuters*. 8 September. https://www.reuters.com/article/us-banks-barclays-blockchain/barclays-says-conducts-first-blockchain-based-trade-finance-deal-idUSKCN11D23B (accessed 15 February 2018).

Kwan, J. 2011. Credit Bureaus in Asia. *Asia Focus*. Federal Reserve Bank of San Francisco. https://www.frbsf.org/banking/files/october-credit-bureaus-in-asia-Oct-2011.pdf (accessed 15 February 2018).

Kuwahara, S., N. Yoshino, M. Sagara, and F. Taghizadeh-Hesary. 2015. Role of the Credit Risk Database in Developing SMEs in Japan: Lessons for the Rest of Asia. ADB Institute Working Paper No. 547. Tokyo: ADBI. https://www.adb.org/sites/default/files/publication/175583/adbi-wp547.pdf (accessed 15 February 2018).

Morgan Stanley. 2015. Global Marketplace Lending: Disruptive Innovation in Financials. 19 May.

Reserve Bank of India (RBI). 2014. Report of the Committee to Recommend Data Format for Furnishing of Credit Information to Credit Information Companies. January. https://rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/APR220314FS.pdf (accessed 22 February 2018).

Reuters. 2017. No More Loan Rangers? Beijing's Waning Support for Private Credit Scores. 3 July. https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2017/aug/Fintech_In_China_Hitting_The_Moving_Target.pdf (accessed 15 February 2018).

Sheng, C., J. Yip, and J. Cheng. 2017. Fintech in China: Hitting the Moving Target. Oliver Wyman. https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2017/aug/Fintech_In_China_Hitting_The_Moving_Target.pdf (accessed 15 February 2018).

Shinozaki, S. 2012. A New Regime of SME Finance in Emerging Asia: Empowering Growth-Oriented SMEs to Build Resilient National Economies. ADB Working Paper Series on Regional Economic Integration. https://www.adb.org/sites/default/files/publication/30110/new-regime-sme-finance-asia.pdf (accessed 15 February 2018).

Son, H. 2017. JP Morgan Software Does in Seconds What Took Lawyers 360,000 Hours. *Bloomberg*. 27 February.

Statista. 2017. Global B2B E-commerce Gross Merchandise Volume. https://www.statista.com/statistics/705614/global-b2b-e-commerce-gmv-region/ (accessed 15 February 2018).

Vandenberg, P., P. Chantapacdepong, and N. Yoshino, eds. 2016. *SMEs in Developing Asia: New Approaches to Overcoming Market Failures.* Tokyo: ADB Institute.

Wass, S. 2017. Fintech Startup Brings Blockchain and Cryptocurrencies to Invoice Finance. *Global Trade Review*. 8 September. https://www.gtreview.com/news/fintech/fintech-startup-brings-blockchain-and-cryptocurrencies-to-invoice-finance/ (accessed 19 March 2018).

World Bank. 2012. Jobs. *World Development Report 2013*. Washington, DC: World Bank.

World Trade Organization. 2016. *World Trade Statistical Review: 2016.* https://www.wto.org/english/res_e/statis_e/wts2016_e/wts2016_e.pdf (accessed 15 February 2018).

Yoshino, N. and G. Wignaraja. 2015. SMEs Internationalization and Finance in Asia. Presentation at IMF-JICA Conference. Tokyo. 18 February. https://www.imf.org/external/np/seminars/eng/2015/jica2015/pdf/1-B1.pdf (accessed 15 February 2018).

CHAPTER 2

How Open Banking Can Support Finance for SMEs

JULIEN MAHUZIER
Interhelpo

2.1 Executive Summary

The purpose of this chapter is to introduce the basic tenets of open banking, its history, and its objectives, with the aim of explaining how and why open banking can be a relevant practice for supporting small and medium-sized enterprises (SMEs).

First, we define the main terms and underlying mechanisms, with a particular focus on the key concept of open application programming interfaces (APIs) and their role in connecting banking systems to the larger ecosystem. We also address the question of fintech (financial technologies and, by extension, firms providing financial services via technology) and observe how traditional financial institutions usually partner and/or compete with fintechs. Next, we examine why and how SMEs struggle with regard to financing, and provide some relevant use cases and examples in which open banking can support the growth of SMEs and ease their access to credit. We will also focus on some of the risks associated with open banking.

Finally, we provide some high-level recommendations to both practitioners and regulators on how to move forward with open banking with regard to managing APIs, organizing data governance, and instilling a culture of innovation necessary for successful open banking.

2.2 Open Banking

2.2.1 | Background and Concept

Open banking refers to the system by which banks[1] share their information with third parties. Banks might be willing to organize such sharing if they are either in a certain leadership position, or playing the role of a challenger and are well equipped with

[1] In this chapter, the term "banks" is used to encompass microfinance institutions as well as other "traditional" financial institutions.

high technology. By taking the initiative, banks are able to assert more authority in decisions relating to the setting of standards. Institutions that lag behind will have less to say. Another obvious factor pushing banks to open their systems and share their information is the role of regulators. In Europe, the European Banking Authority issued the revised directive on payments in early 2018. This new regulation, which will come into force by the fourth quarter of 2019, will affect more than 9,000 banks in 30 countries (European Union members and other European countries that join on a voluntary basis). This new regulation is viewed as one of the most significant game-changers in the banking industry. Despite concerns that the new regulation will create few winners and many losers, European consumers should benefit overall from the increased competition between players in the financial market.

This development is reflected in other leading financial markets, such as those of the United Kingdom (UK) or Australia, both of which closely follow what is happening on the European continent. The Open Banking regulation initiated by the UK's Competition and Markets Authority is meant to be compatible with that of the European Banking Authority, and will go further in terms of system openness. The UK actually began to go in this direction slightly earlier than its continental counterpart, and many of the most interesting examples of open banking actually come from the UK. Its approach has been based on engaging the nine largest banks in the country and deciding jointly how to share information.

In Asia, some of the financial powerhouses—like Japan; Hong Kong, China; or Singapore—also have ambitious objectives with respect to open banking. Less mature financial markets are also striving to move toward more openness; this is notably the case in Nigeria while, in Southeast Asia, Malaysia and Thailand have also begun some first initiatives.

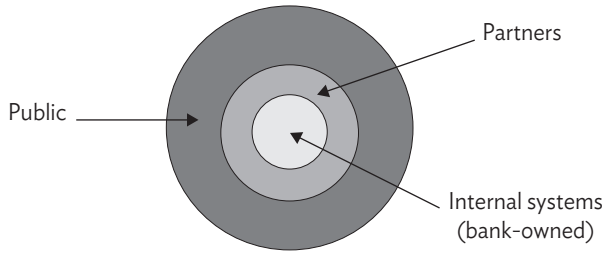
2.2.2 | Open Application Programming Interfaces

To understand open banking better, it is necessary to clarify some of the underlying technical aspects. Although use of the term is spreading, API is still not immediately understandable to all. An API is a standard and agreed-upon way to integrate two or more systems. Using an API sets a standard of data exchange, ensuring that stakeholders "speak" the same language. With respect to open banking, APIs are mostly used to access information from core banking systems.

The use of an API notably provides a more secure and transparent way of communicating information between systems. Before APIs, practices included "screen-scraping" (that is, attempting to parse information from a webpage without a defined and normalized structure of data), and "password sharing" (that is providing the credentials of one's internet banking account to a third-party system to enable it to connect on the client's behalf and extract information). These practices were both dangerous (as there was no guarantee that the login and password would not be used for nefarious purposes), and less reliable (whenever the graphic interface of internet banking changed, screen-scraping would fail in its attempt to gather information). An API can be considered a "contract" between systems—even when a system is modified (for example, due to a system migration or an upgrade) the data provided by this system's API retains the same nature and structure.

APIs are frequently used to connect the various elements of an institution's management information system, or to integrate a bank's management information system with third-party partners and/or providers, such as a credit bureau. When an organization claims to have an open API, it allows not only its partners but also the general public to access its system. This access is generally provided based on certain terms and conditions and is not necessarily free and unlimited.[2] There are many methods and many possible service-level agreements applicable to the use of open APIs. It is therefore highly recommended that certain norms are discussed and enforced to avoid the sub-efficient use of this principle. Whether these norms are dictated by a central regulatory body or by a consortium of stakeholders is a matter of public policy.

Figure 2.1: Different Types of Application Programming Interface Use



Source: Author.

[2] This gives rise to a discussion about the monetization of APIs and the overall concept of an "API economy."

2.2.3 | Partnering with Fintechs

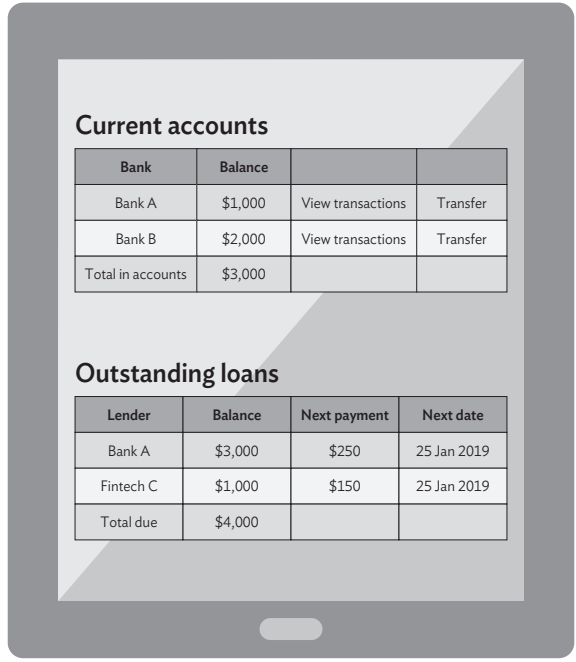
Fintechs are usually leaner and more reactive than traditional financial institutions; they also tend to invest more in certain forms of high technology aimed at solving a very specific pain point, whereas banks offer a broad spectrum of services. Banks also lack the capacity to focus on a specific point or form of technology such as artificial intelligence or to collect certain types of alternative data.

Essentially, fintechs are smaller and have a greater capacity to roll out new products and cope with changes. In terms of the use of high technology, surveys have found that some 46% of large fintechs have invested in artificial intelligence, versus roughly 30% of large banks (PricewaterhouseCoopers 2017). Moreover, fintechs are usually not regulated (and do not want to be, as they prefer to keep their lightweight structure), and are ready to collaborate with traditional financial institutions to do so. This makes it possible for them to offer complementary services and best-in-market products to their large clientele of established players. Some of the most interesting cases are provided by partnerships between online lenders like Kabbage and banks like Santander UK.

Having discussed the objectives, terms, and means of communication between organizations, we now turn to the question of the nature of data. Information shared between organizations usually relates either to know-your-customer procedures (this avoids having to re-capture a customer's information when they open an account in a new institution), or, most importantly, to a customer's past transactions (e.g., payments, transfers, deposits, and withdrawals) and previous loan history (e.g., capacity to repay and late payments). Depending on the legal frame applicable, the institution should explicitly ask for the customer's consent. On top of this information, open banking usually also lets third parties initiate payments or transfers on behalf of the customer.

For example, a customer of Bank A, by sharing his or her information and consenting to transfers and payments made to Bank B, can initiate transfers via the internet or mobile banking interface of Bank B. This also enables Bank B to access the customer's past behavior and offer him or her tailored products and conditions. It is also noteworthy that a customer can share information not only with another bank but also with a fintech. Thanks to information accumulated from various accounts, the third party (bank or fintech) will have a better picture of the customer's financial capacity and will thus be able to establish a more accurate credit score. This model is followed by Mint in the United States, Yolt in the UK, and Money Forward in Japan. It is likely that, in the near future, most mobile and internet banking interfaces will be accessed not via banks but via fintechs.

Figure 2.2: Example of a Mobile Banking Interface Aggregating Information from Several Financial Service Providers



Current accounts

Bank	Balance		
Bank A	$1,000	View transactions	Transfer
Bank B	$2,000	View transactions	Transfer
Total in accounts	$3,000		

Outstanding loans

Lender	Balance	Next payment	Next date
Bank A	$3,000	$250	25 Jan 2019
Fintech C	$1,000	$150	25 Jan 2019
Total due	$4,000		

Source: Author.

2.3 Open Banking for SMEs

2.3.1 | SMEs' Limited Access to Finance

As there are many up-to-date sources of information explaining how SMEs struggle to access finance, it is not necessary to reiterate this point. However, it is useful to emphasize how important access to finance is to SMEs and how constrained this is currently. For East Asia and the Pacific, the credit gap was a staggering $2.4 trillion in 2018 (SME Finance Forum). It is notoriously difficult for financial service providers (FSPs) to assess the creditworthiness of micro, small, and medium-sized enterprises (MSMEs). In many markets, having no assets to be pledged as collateral means that no loans will be provided.

2.3.2 | Use Cases for SMEs

Next, we explore some of the most interesting applications of open banking for SMEs.

Account Aggregation

We have already seen that open banking enables banks or fintechs to access the various accounts of a single person. This pattern is also applicable to SMEs, especially the smaller ones—in many cases there are connections between the MSME owner and the company bank account. For a financial institution, being able to access an MSME owner's bank account details and transaction history provides extra relevant intelligence that can be used to assess the creditworthiness of the MSME more effectively. This can be even more important if the MSME is involved in cross-border trade and/or uses third-party payment systems like PayPal or TransferWise.

Providing Value-Added Services

One recent trend that has emerged (mostly in the UK) is the combined offer of simple bank accounts (held by a bank or a fintech, like Tide) with useful tools for MSMEs such as a payroll solution or an online accounting package. Keeping books is a time-consuming activity for MSMEs, and packages offered by vendors are often not adapted to the needs of the smallest firms. Integrating a simple bookkeeping solution into a bank account allows entrepreneurs to focus on their businesses while spending less time and effort addressing bureaucratic issues. This is even more relevant for freelancers and microenterprises. Further, such online solutions are integrated directly with internet banking services and permit the MSME to perform tax and salary payments in just a few clicks. For the financial institution or fintech offering such a solution, this not only means that the MSME is more likely to use their service, but it also provides them with a treasure trove of extra information about the MSME. Financial institutions can learn the financial metrics of their MSME customer in real time and adapt their services accordingly. For example, they can predict when the MSME is likely to run out of cash and offer them a cash advance or overdraft facility. One final example particularly applicable to the European context is the fact that invoices between SMEs are becoming increasingly digitized. Offering an online interface to issue and track e-invoices and integrating this interface with a bank account would both support the MSME and enable financial institutions or fintechs to provide receivable-based credit services, such as factoring finance.

Access to E-Commerce

In some transition economies where electronic commerce is not yet as structured as in more advanced markets, some players can decide to support their MSME by selling their goods. For example, in Kazakhstan, one of the leading retail banks, Kaspi Bank, has decided to create a marketplace where its MSME customers can sell their goods online. This initiative helps MSMEs establish an e-shop in just a few clicks, without the need for any advertisement, security system, or payment services. These e-shops can also be connected with certain third-party service providers, such as for the storage of goods, deliveries, insurance, and translation of product descriptions for sale abroad or to foreigners. These initiatives do not necessarily need to come from banks but can be instigated by existing e-commerce players, like the marketplace set up by Svetofor in the Kyrgyz Republic. In both cases, access to finance is enhanced for both end-customers and the MSME, and the FSP can provide a lending facility to its customers to enable them to acquire the goods or services sold online.

Open Banking's Challenges

It is clear that MSMEs will increasingly come to use such integrated packages and will approach the financial institutions with the most appealing offers. While the advantages of open banking are obvious, there are also some less positive aspects that should not be downplayed.

First, granting access to one's systems makes it easier for intruders to penetrate a bank's systems via partners, other third parties, or anyone with malicious intentions. A rise in cybercrime can be expected, and banks will be more targeted than ever before. Regional cooperation to address these questions will be critical as cybercrimes are often committed from abroad due to a greater sense of impunity. Beyond the amount of money stolen in such cyber-heists, there is also a significative reputation risk associated with cyber-criminality. This is becoming ever truer as global consciousness grows regarding data privacy and ownership. A bank whose customers' data were "leaked" would certainly face grave consequences.

Moreover, most banks are going to lose large swaths of their customers to fintechs or other banks that are more advanced in terms of integration. This is even more true in the European Union, where some online "pure players" (i.e., a company that operates only on the internet) such as N26 or Revolt have begun to attract customers from all over the continent to the detriment of established institutions. It has been estimated that banks in Europe will face major losses relating to payment fees (some 10% over the next 2 years) (PricewaterhouseCoopers 2017).

To open their systems and mitigate the risk of fraud and cybercrime, banks will need to invest heavily in technology. They will need to patch up their legacy systems and acquire more security-related tools and services. Extra by-product expenditures, such as setting up "sandbox environments" for their APIs, will also impact these institutions financially.[3]

2.4 What Is to Be Done?

2.4.1 | Financial Service Providers

Banks and microfinance institutions will remain the main FSPs for some time, and it is not necessary to convince and educate other players such as fintechs about the opportunities offered by open banking. Thus, this section is mostly useful for banks and microfinance institutions.

Beyond Application Programming Interfaces

As discussed above, APIs are the lynchpin of open banking. However, allowing access to a bank's systems via APIs alone may be insufficient for a successful open banking project. To thrive and ensure real uptake of its use, a bank will have to manage its APIs appropriately. This means developing an API strategy closely tied to the overarching strategy of the institution, and dedicating proper resources to enforce this strategy. A bank needs to keep developing new products and services. Putting APIs at the center of this permanent innovation means to (i) question the business rationale of those new products (e.g., asking whether an existing third party could provide a better service using the current system and connecting via the bank's API); and (ii) ensure that, whatever the decision regarding such a question, the development of a relevant API to access this new service or product is planned and scheduled.

However, planning, developing, and providing access to an API is not completely sufficient. To attract partners and foster innovation, a bank must take a proactive management role. This means making overall access to the institution's API easy and straightforward for fintechs and their developers. There are various levels of maturity in terms of the management of APIs. First of all, proper and up-to-date documentation illustrated by meaningful examples and access to some sandbox

[3] A sandbox is a testing environment that isolates untested code changes and outright experimentation from the production environment.

environments will pave the way to projects based on the bank's ecosystem. Active management also means organizing the community of developers operating the bank's sandbox by setting up electronic forums (e.g., Telegram or Slack channels[4]), and organizing events such as hackathons during which teams of developers are encouraged to solve specific challenges posed by the bank.

Last, more mature management involves the "community" in the planning of the API road map, that is, including existing and potential partners of the bank when organizing a governance about the development of access to its ecosystem. This would help the bank better understand the needs of those partners in terms of data to be obtained, as well as other, more technical, questions such as the granularity of the APIs.[5]

Data Governance

A financial institution must have structured data governance. In particular, it must have a clear idea of the data it owns and uses, its up-to-dateness, and its integrity; and it must be able to identify on which systems the data are stored (data mapping), and whether they are redundant and/or accurate. Financial institutions also must devote some resources to this end, such as a data focal point capable of handling these questions hand-in-hand with the various business departments. Most importantly, they must have a data strategy identifying the data that the bank must acquire, at what pace and cost, and the best way to obtain this information (e.g., via third-parties, digitizing certain existing processes, or creating new digital processes).

Data governance also covers policies regarding "Big Data" or data warehouses, and what to do with some of the unstructured data collected by the bank (e.g., setting up a data lake for later use). In particular, it must understand what and when data are useful. It is always costly to retrieve, process, and store information, while it is easy to succumb to a trend or to the discourses of consultants or sales representatives.

Finally, the bank must ascertain that the relevant data are accessible to the departments that need it. This can mean that the data are either accessible in "read-only" mode (i.e., via reports or business intelligence solutions), or consumed by systems to automate certain processes (e.g., credit scoring). Naturally, data must be accessible only by those that really need it. Provisions for the security of storage and traceability of access are critical, and banks cannot skimp on dealing with questions such as encryption and data confidentiality.

---

4 These two tools are widely popular among developers and fintech staff.

5 An API is said to be granular when it permits rich extraction of data, instead of a large, unbundled set of data.

Nurturing a Culture of Innovation

Banks, like all institutions, struggle with innovation. This is due to heavy regulations, an acute hierarchy (vertical organization), a culture of secrecy, and a general aversion to risk. On top of this, banks are usually encumbered with rigid and costly legacy information systems that are difficult to change. Although it is difficult to change the mentality of an institution, this is essential for the fundamental aspects of open banking to be accepted. Although there is no single way to do this, the following practices are recommended:

(i) Remove "silos" between departments and set up smaller, more horizontal teams to answer specific questions. Teams could be supplemented by non-staff to bring in new ideas.
(ii) Identify interesting fintechs with which to partner. The search can extend beyond existing markets (in terms of customer segments and country) to see what can be replicated.
(iii) Instill a spirit of "trial and error" to diminish aversion to risk. This should accompany the use of sandbox environments and could identify certain customers interested in testing new products. This approach, which is apt for experiments, can help in designing and piloting proofs of concept.
(iv) Ease certain regulations and risk mitigation measures for certain pilots.

2.4.2 | Regulators

Regulatory Sandboxing

Finally, we briefly address the role of the regulators in enhancing access to finance for SMEs. The point raised above regarding the culture of innovation for banks applies, to a certain extent, to regulators as well. The most advanced financial markets, such as the UK or Singapore, have all invested significantly in the concept of a regulatory sandbox that has emerged in recent years. It is also noteworthy that some less mature markets, notably in Africa, have been cooperating successfully with FSPs to introduce new products that had been stuck in regulatory "grey zones." This has been the case in Kenya with regard to mobile money and new digital financial services such as nanoloans. Despite a growing debate about the efficiency and fairness of the latter, the light-touch "wait and see" approach of the regulator permitted and even encouraged innovation that would not have been possible otherwise.

Regulating Open Banking

While engaging the industry and its stakeholders is essential to develop a thriving open banking scene, it might also be necessary for the regulator to impose certain rules to prohibit large players from hanging back. Each case and each market are different (for example, the European experience might not be usefully applicable to the case of a single country), but without a certain impetus from the regulator, open banking initiatives would only benefit the largest banks, leading to an oligopoly detrimental to the consumers. This could also crowd out new entrants and rein in innovation. Some points to be determined include (i) the nature and the scope of the APIs, (ii) the terms to access them, (iii) necessary levels of security, and (iv) the imposition of a schedule for the introduction of these APIs. This list is a baseline and can certainly be elaborated upon. Finally, regulators will have to inform practitioners of the proper rules with regard to data ownership, confidentiality, and consumer protection that might be affected by open banking.

2.5 Conclusion

It is undeniable that open banking offers both great opportunities and great challenges. On the one hand, it will spur further innovation in the financial sphere, solving some of the issues faced by SMEs, especially the problem of poor access to credit. On the other hand, opening the gate to external players (some smaller, less robust, and unregulated) will certainly entail some problems, especially in terms of cybercrime and fraud. Also, one should not underestimate the hefty investments necessary to enable the technology that underlies open banking, such as the upgrading of infrastructure and security hardware and software, and the human resources required to run them properly.

Doing nothing is probably not an option. Regulations will come eventually and competitors, both incumbents and new entrants, will respond accordingly. Thus, financial institutions should take a controlled and measured approach to implement open banking. Opening systems progressively and starting by partnering with certain selected fintechs before opening the environment fully will allow banks to fine-tune their API strategy and business model. Engaging the regulator on these questions will also ensure a smoother adoption of the new rules.

While banks still perceive fintechs as challengers, win–win cases are becoming more frequent and are being trumpeted. Learning on the job will be also essential before a more extensive opening can take place. This will help foster a culture of innovation within a firm and ensure that it does not lag too far behind. However, there is no "one size fits all" approach, and the steps to be taken ultimately depend on the market, customers, and regulation.

References

PricewaterhouseCoopers. 2017. Redrawing the Lines: FinTech's Growing Influence on Financial Services. *Global Fintech Report 2017*. https://www.pwc.com/jg/en/publications/pwc-global-fintech-report-17.3.17-final.pdf.

SME Finance Forum. http://www.smefinanceforum.org/ (accessed 20 February 2019).

CHAPTER 3

Application of Distributed Ledger Technologies to Improve Funding in the Startup Ecosystem

NAOYUKI YOSHINO
Asian Development Bank Institute and Keio University

FARHAD TAGHIZADEH-HESARY
Waseda University

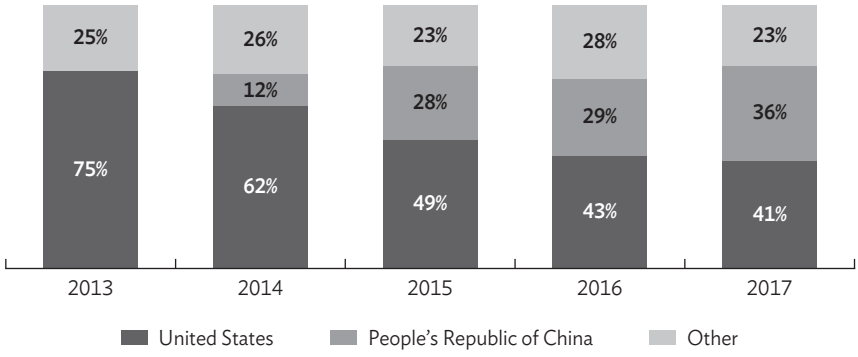
3.1 Introduction

Successful startup businesses can play a significant role in economic growth and job creation. They also contribute to economic dynamism by spurring innovation and injecting competition. Startups are known to introduce new products and services that can create new value in the economy. As pointed out by Kane (2010: 2), "without startups, there would be no net job growth in the U.S." However, the role of startups in supporting the overall healthy functioning of an economy is less commonly pointed out. Business startups account for about 20% of gross (total) job creation in the United States (US), while high-growth businesses (which are disproportionately young) account for almost 50% of gross job creation (Haltiwanger, Jarmin, and Miranda 2013; Haltiwanger 2012).

Startups also play a significant role in job creation and economic growth in many other countries outside the US, such as the People's Republic of China (PRC). If the startups can survive and become giants and unicorns,[1] they can significantly impact job creation. Figure 3.1 compares unicorns born in the US, the PRC, and the rest of the world.

[1] A unicorn startup or unicorn company is a private company with a valuation of over $1 billion, a decacorn is valued at over $10 billion, and a hectocorn is valued at over $100 billion.

Figure 3.1: Unicorns Born in the United States, the People's Republic of China, and the Rest of the World, 2013–2017[a]



[a] Through 28 September 2017.

Source: CB Insights. 2018. https://s3.amazonaws.com/cbi-research-portal-uploads/2017/10/03140919/1uni.png (accessed 19 December 2018).

It is notable that most startups exit within their first 10 years, and most surviving young businesses do not grow but remain small. However, a small fraction of young firms exhibits very high growth and contributes substantially to job creation. These high-growth firms make up for nearly all of the job losses associated with shrinking and exiting firms in their cohort. The implication is that each entering cohort of startups makes a long-lasting contribution to net job creation (Decker et al. 2014). In recent years, new unicorns born outside the US have proliferated, especially in the PRC where the share of new unicorns has consistently grown every year since 2014. In 2017, one-third of all unicorn births (16) occurred in the PRC, while 41% occurred in the US. As of 19 December 2018, there were 326 unicorn companies in the world, with a total cumulative valuation of about $1,031 billion. Of these, 150 are from the US, 83 are from the PRC, and 93 from the rest of the world (CB Insights 2018b).

Startups in other parts of the world (especially Asia) face several obstacles to their development, and only a few will ever become unicorns. For example, Japan has only 1 unicorn,[2] and the Association of Southeast Asian Nations (whose total gross

[2] Preferred Networks was established as a spin-off company from Preferred Infrastructure, a software development company with expertise in natural language processing and machine learning. Major investors of Preferred Networks are Toyota Motor Corporation, Mizuho Financial Group, and FANUC.

domestic product reached $2.76 trillion in 2017) has four unicorns, all in Indonesia. The Ministry of Economy, Trade and Industry of Japan recently launched a program, known as J-Startup, to recognize and support startups with the potential to become unicorns. Through this program, the Government of Japan has set a national goal of 20 unicorns by 2023, by incubating promising startups that are expected to expand business internationally and become role models. The Ministry of Economy, Trade and Industry of Japan aims to use this program to improve Japan's startup ecosystem. Nevertheless, it is important to mention that not all startups necessarily hope to become giants and unicorns, and many startups would prefer instead to remain small and medium-sized enterprises (SMEs) producing novel technologies or high-quality products.

Finance is a key constraint on the development of startups. Most startups have difficulties accessing finance because they lack a historical background, making it difficult for lenders to assess their risk. In addition, most are in early stages of development and face a very high possibility of failure, which significantly raises the risk of financing and investment. Venture capital has been developed in the US and other western countries and has recently emerged in the PRC as well; however, venture capital is not popular in many other countries, especially in Asia. Banks are the main source of financing and they dominate the financial markets in most Asian countries. In addition to the widespread difficulties faced by startups and SMEs in fundraising from banks, the recent Basel Capital Accord has made this environment even harsher. Basel III introduced new rules—liquidity frameworks and leverage ratio frameworks—to strengthen the risk management of banks, while also introducing strengthened capital requirements. These new measures may prevent banks from providing long-term credit to enterprises, and may limit financing options for startups and SMEs (ADB 2015).

Given the lack of venture capital and the risk-averse environment in most Asian countries, and considering that banks are often not interested in or not allowed to finance risky businesses and startups, new innovative forms of raising money are needed. To increase the flow of funds to the startup sector, it is important to develop a scheme to reduce the information asymmetry between the borrower (the startup) and the lender or investors, reduce the risk of investment, and increase the rate of return. This will boost willingness to invest, and can ease startups' access to funds.

This chapter presents the idea of using the technological features of distributed ledger technologies (DLTs) such as blockchain to enhance the existing community-based scheme of hometown investment trust (HIT) funds. HIT funds, a new type of community-based trust fund, were initiated in Japan after the Fukushima nuclear

disaster in March 2012 that led to a nuclear shutdown across the country. These funds became a successful scheme especially for absorbing investments in small and medium-sized renewable energy projects, such as solar and wind power generators (Yoshino and Taghizadeh-Hesary 2018). The development of these funds is based on investors' trust. Creating further trust within the funds makes it possible to expand the investor pool to private persons in other countries, thus facilitating investments across borders. As an alternative to classical financial or capital markets, this can bring capital to regions that face financial friction in the classical setting. Based on the idea of a one-world community, this tool aims to bring together people who previously would not have collaborated to provide funding for necessary investments in startup businesses. DLTs will bring more transparency, and more trust for investors as a result. In addition, the existence of a big data information infrastructure, that is, a credit risk database for startups (CRDS), can help in assessing a startup's credit risk by only introducing startups with a higher probability of success and rate of return.

This chapter provides a theoretical model of a scheme that, by implementing DLTs along with a CRDS, will boost the trust of investors and projects' rates of return. As a result, the flow of funding to startup businesses through HIT funds will increase and help fill the financing gap, making it possible for startup businesses not to rely wholly on bank financing.

3.2 Literature Review

Four categories of earlier studies related to the subject of this chapter were selected for review: (i) startup ecosystems and startup finance; (ii) the role of credit risk assessment and credit risk databases (CRDs) in reducing information asymmetry; (iii) the social funding of risky businesses, or the role of HIT funds in filling the financing gap of risky sectors; and (iv) DLTs.

3.2.1 | Startup Ecosystem and Startup Finance

To support startups, it is important to understand the startup ecosystem and shape it in such a way as to facilitate the growth of these firms. However, few studies address this ecosystem. Tripathi et al. (2019) conducted a multi-vocal literature review of 63 articles to identify major elements in the startup ecosystem and determine their roles. They found various definitions of this ecosystem that used common terms, such as stakeholders, supporting organization, infrastructure, network, and region.

Of 63 articles, 34 were opinion pieces, with contributions in the form of reports, and more than 50% were thoroughly relevant to the startup ecosystem topic. They also identified eight major elements of a startup ecosystem (finance, demography, market, education, human capital, technology, entrepreneur, and support factors) that affect startups either directly or indirectly. In another study, Hirsch and Walz (2018) aimed to expand the sparse knowledge on the financing dynamics of newly founded firms by investigating 2,456 French manufacturing firms founded between 2004 and 2006. They observed significant heterogeneity in the financing decisions made at the time of the firms' foundation, and analyzed whether these differences widen or converge by using different convergence concepts. They consistently found β-convergence, indicating that the initial financing decisions negatively affected the accumulation of this source of financing. They also found mixed results after investigating the development of variation in financing patterns across firms over time (σ-convergence). While differences in debt composition (e.g., role of trade credit, bank loans, and the relationship between short- and long-term debt) vanish over time, the opposite is true for debt–equity mixes. In another study, Davila, Foster, and Gupta (2003) examined the association between the presence of venture capital and the employee growth of startups. Grounded in signaling theory, this study investigated the impact, if any, of venture capital financing events on the growth of these companies and whether the amount of funding affects the intensity of the signal. Their findings show that a significant relationship exists between growth in startup financial valuation and changes in the number of employees after successive rounds of financing.

3.2.2 | Credit Risk Assessment and Credit Risk Databases

Extensive empirical research devoted to analyzing the stability and soundness of large corporations dates back to the 1960s. Ravi Kumar and Ravi (2007) provided a comprehensive survey of the application of statistical and intelligent techniques to predict the likelihood of default among banks and firms. However, despite its obvious relevance, the development of reliable quantitative methods for predicting large corporations' credit ratings has only recently begun to attract strong interest. Poon, Firth, and Fung (1999) developed logistic regression models for predicting financial strength ratings assigned by Moody's using bank-specific accounting variables and financial data. Factor analysis was applied to reduce the number of independent variables and retain the most relevant explanatory factors. The authors showed that loan provision information and risk and profitability indicators had the greatest predictive value in explaining Moody's ratings. Yoshino, Taghizadeh-Hesary, and Nili (2015) used two statistical analysis techniques on various financial variables taken

from bank statements for the classification and credit rating of 32 Iranian banks. The underlying logic of both techniques—principal component analysis and cluster analysis—is dimension reduction, that is, summarizing information on numerous variables in just a few variables. Their results classified 32 banks into two groups and sorted them based on their credit ratings.

While the examples mentioned above refer to the credit ratings of large corporations and institutions, the story is different for SMEs due to the lack of, and difficulty of collecting, reliable data. This is even more difficult for startups because they often lack a credit history and financial statements. The literature on the credit rating and credit risk assessment of SMEs and startups is scarce. Fernandes and Artes (2016) proposed a means of measuring local risk of default based on the application of ordinary kriging to a data set of 9 million SMEs in Brazil. They included this variable in logistic credit scoring models as an explanatory variable, and their model performs better than models without this variable. Yoshino and Taghizadeh-Hesary (2014) developed a model for credit rating of SMEs by employing two statistical analysis techniques—principal component analysis and cluster analysis—to analyze the credit risks of a sample of Iranian SMEs using their financial variables. The comprehensive method they designed and developed is novel, and their test results show that the accuracy of this model, which considers different aspects of SMEs (leverage, liquidity, profitability, coverage, and activity), is higher than that of conventional probit or logit and other binary response models. Kuwahara et al. (2016) offer a successful example of a Japanese CRD that is devoted to SMEs. The CRD Association is a membership-based institution whose members (credit guarantee corporations and financial institutions) support the database by providing data from SME financial statements. The researchers explain that the Small and Medium Enterprise Agency of Japan's Ministry of Economy, Trade and Industry allocated just over ¥1.3 billion (about $11 million) in supplementary funding in fiscal years 1999 and 2000 for the development and demonstration of systems required by the CRD. As the CRD's membership has increased, the funding contribution from the public sector has decreased. The goal of establishing such an information infrastructure was to mitigate information asymmetry between SMEs and lenders (or guarantors) and contribute to the provision of funds based on appropriate pricing. Credit guarantee corporations, the main members of the CRD, have used the CRD scoring models since April 2006. Credit guarantee corporations are charging credit guarantee premiums to SMEs based on the credit score issued by the CRD. A healthy SME pays a lower premium rate and a risky SME pays a higher premium rate. The CRD contains information on both incorporated and sole-proprietor SMEs, and contains statements from more than 3 million SMEs. As there are around 4 million SMEs in Japan, the CRD contains information on three-quarters of the enterprise

population. Although the CRD is playing a significant role in reducing information asymmetry for the SME sector, startups continue to face difficulties due to their lack of a credit history, which makes it impossible to develop conventional credit assessment techniques based on quantitative criteria. Thus, it is very important to build a judgmental rating model mainly based on qualitative criteria (soft information) to finance startup activities. Until now, there has been almost no multicriteria credit-risk model based on soft information for startup businesses, and literature on this subject is also scarce. Angilella and Mazzù (2015) presented a credit-risk model and implemented an analysis to assign robust SMEs and startups to different risk classes. They considered different sets of preference parameters and uncertainty in the data via Monte Carlo simulations.

3.2.3 | Social Funding of Risky Businesses: Hometown Investment Trust Funds

Alternative sources of financing for startups in both developed and developing countries usually include friends and family, loans, angel investors, accelerators, venture capital, and public markets (through initial public offerings). Another successful scheme of special community-based trust funds are HIT funds, a new scheme of social funding initiated in Japan for socially funding smaller-scale solar and wind power projects (which are seen as risky). The basic objective of these funds is to connect local investors with projects in their own locality. Individual investors choose their preferred projects and invest small amounts (about $100–$5,000 per investor) via the internet (Yoshino and Kaji 2013). Following their success in the renewable energy sector, HIT funds are expanding to other sectors including agriculture and fisheries, as well as new technologies that cannot raise money from banks. If these projects are run properly and well received by individual investors, banks can start granting them loans. In this way, startups can be supported by HIT funds until they are able to borrow from banks. The Hokkaido Green Fund, which was established in 2000 to finance wind-power projects in northern Japan, was mainly generated by donations and HIT investors. As it was difficult to raise money from banks, only 20% of total investments were financed this way, while the other 80% were obtained from individual investors and through donations. The community wind-power corporation captures wind power and sells the generated electricity to the local power company that supplies power to the region. More than 19 wind-power projects were realized in northern Japan through a similar method. There are also examples of solar-power projects in Japan where local governments contribute seed money to the community fund as an incentive for private investors to participate.

Another example is the revitalization of an old hydropower plant in Japan's Nara prefecture. It was constructed in 1914, but abandoned and demolished decades later. Through the participation of the local community and 274 individual investors (one unit of investment was $300), the plant was revitalized via HIT funds, with a total investment of $500,000. The revitalized dam provided 184 households with electricity, as well as revenue from the sale of surplus electricity to the power supply company in the region (Yoshino, Taghizadeh-Hesary, and Nakahigashi 2019).

Banks still dominate Asia's finance sector (see Yoshino and Kaji [2013] and Yoshino and Taghizadeh-Hesary [2015]), and venture capital markets are generally not well developed. However, internet sales are gradually expanding and the use of alternative financing vehicles such as HIT funds can help risky sectors in Asia grow. This can be seen in the case of HIT funds that have supported the growth of solar and wind projects in Japan (Yoshino and Taghizadeh-Hesary 2017), as mentioned above. Since then HIT funds have expanded to Cambodia, Viet Nam, and Peru, and they are also attracting attention from the Government of Thailand as well as the central banks of Malaysia and Mongolia.

Although HIT funds are a form of crowdfunding, they differ from conventional types of crowdfunds in several significant ways: (i) there is a "warm feeling" behind the HIT funds because investors sympathize with the company or project owners and are not merely seeking to make profit; (ii) investors are willing to receive products or services generated by the project (e.g., electricity) instead of solely a share of profits; (iii) the intermediator or assessor of a HIT fund frequently monitors the project's functioning and provides advice when the project faces difficulties; and (iv) the HIT fund invests in a specific project or individual rather than a group of projects. Such a fund represents a direct investment in a project or individual. Trust is key in this framework, and any technology that increases the transparency of the fund will improve its functioning. This is where DLTs come into play.

3.2.4 | Distributed Ledger Technologies

Several economic sectors are exploring or have already begun to implement DLTs (mainly blockchain-based) as they offer a wide range of potential applications (Hanl 2018). Only the future will tell whether they will revolutionize the shipping (Park 2018), banking (Manson 2017), supply-chain management (Swami 2018), or finance sectors (Tapscott and Tapscott 2017). Nonetheless, due to their inherent characteristics of all-embracing security, transparency, and auditability, technologies like Bitcoin, Ethereum, and IOTA offer unique technical features that can be used

to shape financial transactions in the future. Distributed or shared ledgers store data across a distributed network of participants. The accuracy of the data is ensured by obtaining the consensus of all interacting parties. To accomplish this, different technical approaches can be employed, the most famous of which is the blockchain, on which the popular cryptocurrencies Bitcoin and Ethereum are based. In this case, the distributed ledger is created by combining blocks of valid transactions into a chain of blocks that is shared by the entire network. Before being attached to the chain, each transaction within each block must be verified by the majority of the distributed network of participants. This happens through the solving of cryptographic algorithms, which require proof-of-work of each participant, meaning computing power. Participants who provide computing power are commonly referred to as "miners" since they are mining new blocks by verifying bundles of transactions. If they are chosen to mine the next block they gain newly mined coins as well as transaction fees paid by users who want to have their transactions executed. This procedure ensures secure, trusted, auditable, and immutable transactions. If the network is public like Bitcoin or Ethereum, every single transaction on the public ledger is visible to the public.[3] Apart from these unique features, classical blockchains face an enormous limitation (Yoshino, Schloesser, and Taghizadeh-Hesary 2018). Since large amounts of transactions should now be carried out on the network, "[c]onsensus latencies on the order of an hour and the theoretical peak throughput of only up to 7 transactions per second" have become critical (Vukolic 2015). The trend of executing arbitrary distributed applications on blockchains requires a rapid throughput of transactions, which cannot be obtained using blockchains. Moreover, the existing financial rewards for miners created networks that centered around a few powerful actors, contradicting the initial idea of a decentralized system. An additional limitation is the immense amount of energy needed to provide the necessary computational power (O'Dwyer and Malone 2014). To overcome these issues, a variety of approaches were initiated. The use of a directed acyclic graph instead of a blockchain to sustain consensus appears particularly promising. The IOTA protocol, which is based upon a directed acyclic graph called the "tangle," provides a secure, decentralized, and permission-less system that aims to be the backbone of the internet of things (Popov 2016). Each network participant who wants to attach his or her transaction to the tangle must confirm the validity of two other transactions before their transaction can be confirmed by other participants. Confirming a transaction requires only a small proof-of-work since the protocol was designed to enable small devices to participate in the network. This means that users hold up the network, and there is no need for

[3] Private blockchains that restrict the access of potential participants are also used, such as a company that uses a private blockchain to provide a specific service to their customers.

another party like miners. Consequently, transaction fees become obsolete (Hanl 2018) and less computational power is needed, reducing energy consumption relative to Bitcoin. As a result, it is possible to send non-value transactions consisting only of information, meaning that information can be securely stored within tangle transactions. Another feature of the protocol is that, the more the system is used, the faster transactions will be confirmed. In general, the IOTA protocol aims to solve the major technical flaws of blockchains by building on a different consensus mechanism. To develop the protocol further, in 2017 the initial developers and early supporters founded the nonprofit IOTA foundation, which cooperates with the community, academia, and companies to foster its technical enhancement and application in the real world (IOTA Foundation 2017).

Furthermore, some DLT protocols support the use of immutable smart contracts. Once started they will carry out their code, which is defined by interacting parties beforehand, whatever happens. Put more simply, if certain criteria are met by all parties, then XY will happen. This concept allows for proper, distributed, heavily automated workflows and redefines how interactions between transacting parties on a network can be set up and automated (Christidis and Devetsikiotis 2016). The Ethereum protocol has supported smart contracts since it was developed, while they were only recently introduced on top of the Bitcoin blockchain (Hertig 2018). There are also plans to support small contracts with IOTA protocol (Rottmann 2018).

3.3 Ecosystem of Startups Based on Distributed Ledger Technology

3.3.1 | Objective

Our goal is to introduce a desirable scheme for improving the startup ecosystem by providing funding and a marketing mechanism. As mentioned above, two obstacles limit the funding of startups: risk and rate of return. In the scheme proposed in this chapter and summarized in Figure 3.2, we enhance the functioning of HIT funds by utilizing the security, transparency, auditability, and smart contract features of DLTs. This may expand the investor pool to individuals from local and domestic contexts, or from countries other than the one in which the project is realized. Since the spatial closeness feature of HIT funds disperses in such a setting, this global community-based approach requires another source of risk mitigation. The use of DLTs enhances trust in the proper functioning of the funds, which reduces the risk attached to an

investment through a HIT fund. It therefore enables direct investments between partners who would previously not have collaborated, by bringing together individual investors from different countries to invest in specific startups in the private sector. If projects are properly conducted and well received by individual investors, their credit rating increases and it becomes easier for them to receive other loans from conventional financial institutions. Although DLT provides transparency and trust for the investors as they can trace their funds and know where their money is invested, this is not sufficient as it is also necessary to address the other important obstacle: rate of return. In this scheme we consider a CRDS that will act as the credit assessor and evaluator of the success or failure of a startup business. In addition to the credit risk assessment role, CRDS is providing consulting services to the startup project in order to reduce the credit risk and improve the rate of return of the project.

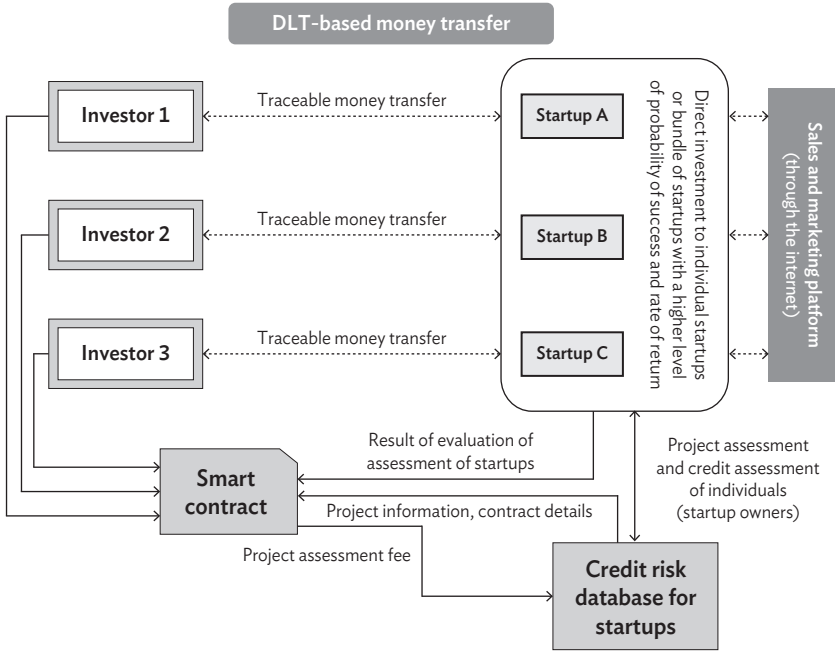
The second major obstacle to growth that many startups face is difficulties with sales and marketing. In this scheme, we propose establishing intermediate sales companies that can provide an online sales platform for products and/or services of startups. Such companies are active in many countries including Japan, the Republic of Korea, and the PRC. In Japan, these intermediate companies are regulated by the Financial Services Agency, which regulates and supervises the financial system. The functioning of each sector is described in section 3.3.2.

3.3.2 | Functioning

Figure 3.2 illustrates the proposed scheme for improving the startup ecosystem using HIT funds based on DLTs, the CRDS, and an intermediate platform for sales and marketing. The conventional CRD, such as the example in Japan mentioned in section 3.2.2, is for operating companies with an established credit history and background; however, startups lack such a historical background. Thus, we are proposing a CRDS that can accumulate the credit history of individuals, because each startup is established by one or several individuals, and individual investors have credit histories and recorded credit behavior that could be assessed to provide a benchmark for the credit risk level of the established startup. Yet, it is not sufficient simply to assess the credit history of a startup's individual founders. The CRDS must estimate the probability of success or failure of the startup based on current feasibility studies, the business model, a qualitative assessment of the managerial skills of the founders and administrative team, and their marketing and sales abilities, among other factors. The CRDS will only introduce startups that score higher based on the credit score and probability of success, and a higher rate of return to the investors.

The results of this assessment are stored in the CRDS, which is grounded on a DLT (blockchain or tangle) so that the stored data cannot be changed once included. Moreover, project issuers (startups) provide project details and determine the terms and conditions of future investment contracts that they hope to conclude. On the other hand, investors are entering a smart contract that regulates the entire business relationship among all three parties. Together with the assessment and hard facts of the project, investors are provided with the necessary information to make their investment decision. If they decide not to invest, nothing happens and they leave the table. However, if investors decide to invest, the contract is automatically set in motion. As soon as enough investors are found to provide the necessary investment sum, the HIT fund can offer funding for the project. The service fee is transferred to the CRDS and the investment sum is forwarded from investors to the project, while future revenue shares are transferred the other way.

Figure 3.2: Improving the Startup Ecosystem Using Distributed Ledger Technology



DLT = distributed ledger technology.

Source: Authors.

The CRDS fee could be a success-based fee in the form of a certain percentage of the investment sum. This would act as an additional incentive for the database to conduct rigorous risk assessments and validate only those startups with a higher probability of success and better credit score, that are received well by investors. Investors are free to finance a single startup or to diversify their portfolios by bundling investments with different assessment results. Also imaginable is an investment-matching feature that allows the investor to define his or her requirements for potential investments (e.g., amount, return, duration, sector, and country); as soon as a project enters the stage in which it matches those requirements, the smart contract would be automatically executed, and the investment made.

3.3.3 | Features

The proposed scheme has several benefits. First, it establishes a direct connection between the investor and the project issuer (startup) by utilizing the auditability characteristic of DLTs. Investors are able to track money streams, thus ensuring that their money reaches the chosen project so that the legitimacy of money transfers is continuously secured, reducing the risk that money will be misappropriated on the way between investor and the startup project. This creates transparency and trust. Second, the presence of the CRDS will increase the rate of return of the startup projects and reduce the risk of investment because, after evaluation and assessment through the CRDS, only startups with a higher level of probability of success, better credit score, and higher rate of return will be introduced to the investors. Third, as the CRDS has access to a startup's information and can evaluate it, it has enough expert knowledge to help and advise the startups to improve their creditworthiness to be eligible for further fundraising. Fourth, reducing the power of the intermediating party can reduce service costs and forward investments more efficiently. Fifth, smart contracts are executed if the investors agree with the contract details. This ensures that the contract details will be fully implemented without any possibility of changing in the future. This feature creates trust and security for all parties. Sixth, only the technical features of DLTs are essential for the functionality of the instrument; the use of Bitcoin, Ethereum, or IOTA as currency is not a requirement. The money streams could take one of two forms. If they take the direct form of a cryptocurrency, this would mean, for example, that IOTAs would be directly invested in a project. If the stream took the form of an automatic combination with a fiat linkage, this would mean that when an investment in, for example, yen is made, the amount is automatically exchanged in the cryptocurrency used to conduct the transfers. Both designs ensure traceability, security, and full transparency for all parties.

3.3.4 | Crucial Points

For the proposed scheme to be implemented successfully, several crucial points must be addressed. First, as the key creator of trust, the CRDS must be reliable and trustworthy for investors as well as projects. For existing HIT funds, internet companies have established a reputation in evaluating startup projects and have a wide reach to potential investors. This party only connects investors and projects and assesses projects; it is not involved in transmitting money or information. With regard to existing HIT funds in Japan, the Financial Services Agency supervises and regulates intermediating parties only, not the HIT funds directly (Yoshino and Taghizadeh-Hesary 2018). Since they are only intermediators and assessors, these are not regulated as asset management companies, meaning that HIT funds are not guaranteed by the government or the deposit insurance corporation. Second, accounts must be connected explicitly with projects, investors, and the assessor (the CRDS), which must be verified by the scheme supplier. This guarantees that every investor and project really exists, and nobody can pretend to be someone else. Therefore, the legitimacy of the interacting parties is ensured. Third, the smart contract must have binding legal status for both parties. If the project issuers try to commit fraud, for example, by not paying future revenue shares, the smart contract must be enforced like a normal contract.[4] Fourth, the design requires an exchange to fiat money; otherwise, the investment sum cannot be used in the real world (Yoshino, Schloesser, and Taghizadeh-Hesary 2018). Fiat money is scarce, meaning that the tool supplier must provide the exchange of the cryptocurrency to local currency. However, this exchange can be done automatically and takes place within a short period of time, meaning that cryptocurrency price volatility is only briefly relevant. Since the mechanism works in both directions, this volatility will only have small financial implications for the exchange provider. In this respect, low or no transaction costs and rapid transaction turnovers are important characteristics of the chosen DLT, and should work to mitigate the described issue. Therefore, we recommend deploying the IOTA protocol. Fifth, exchange rate fluctuations must be incorporated since investments are likely to be made in a different currency than the one that the project requires (Nelson and Shrimali 2014).

[4] The possibility of fraud is already mitigated by the use of smart contracts, which automatically execute payments.

3.4 Model

In this section we show how developing DLT-based HIT funds by incorporating the CRDS can reduce the risk and increase the rate of return of startup projects and ease their access to investments by developing a theoretical model:

$$Y_t = \left(1 + \theta_t^S\right) F(K_t, L_t) \tag{1}$$

Equation (1) shows the production function of startup businesses, and shows that the output of the firm is the function of two production inputs: Labor (L) and Capital (K). θ_t^S shows the better selection of startups thanks to the scheme proposed in this chapter, and the sales-marketing platform that enables the selected startups to provide higher returns for the investors (higher output).

This raises the rate of return, as follows:

$$r_t^S = \frac{\delta Y}{\delta K}\left(1 + \theta_t^S\right) > \frac{\delta Y}{\delta K} = \tilde{r}_t^S \tag{2}$$

where r_t^S shows the rate of return of startups in the proposed ecosystem and $\tilde{r}_t^S$ is the rate of return of normal startups outside this ecosystem.

In addition, due to existence of the CRDS and DLT-based HIT funds, the risk associated with startups will be lower:

$$\sigma_t^S = E\left(r_t^S - \overline{r}_t^S\right)^2 < E\left(\tilde{r}_t^S - \overline{\tilde{r}}_t^S\right)^2 = \tilde{\sigma}_t^S \tag{3}$$

where σ_t^S shows the risk of investment in startups in the proposed ecosystem, and $\tilde{\sigma}_t^S$ is the risk of investment in startups outside this ecosystem (the latter is larger).

To show how these differences in the rate of return and risk occur, in this section we develop a theoretical model. First, we acknowledge that the utility function of the investors (households) depends on the rate of return and risk. Equation (4) shows the utility function of investors, which is a function of rate of return and risk:

$$U = U(r_t, \sigma_t) = r_t - \beta\sigma_t^2 \tag{4}$$

where r_t denotes the rate of return, σ_t denotes the risk, and β is the weight of the risk. If an investor gives more weight to the risk, then β will be larger. A smaller β means that the investor is not as concerned about risk.

In DLT-based HIT funds, the σ_t (risk factor) is expected to be smaller than that of conventional HIT funds because the transparency of the investment is higher since the investors can trace where their money is being invested. In addition, thanks to the evaluation and credit assessment functions of the CRDS, r_t is expected to be higher compared to conventional HIT funds, as the CRDS is accumulating big data on individuals.

Equation (5) shows the total rate of return on households' investments. We assume that households put their money either in bank deposits or in HIT funds that will be invested in startup projects.

$$r_t = \alpha_t r_t^D + (1-\alpha_t) r_t^S \tag{5}$$

In Equation (5), we assume that α_t percent of households' assets is going to bank deposits, and the rate of return on bank deposits (or the deposit interest rate) is r_t^D. On the other hand, $(1-\alpha_t)$ percent of the assets are invested in HIT funds for investing in startups, and r_t^S denotes the rate of return on these funds.

$$\sigma_t^2 = \alpha_t^2 \left(\sigma_t^D\right)^2 + \left(1-\alpha_t\right)^2 \left(\sigma_t^S\right)^2 \tag{6}$$

Equation (6) presents the aggregated risk in quadratic form. Two types of risk are associated with households' investments: (i) the deposit (σ_t^D), and (ii) HIT fund investments in startups (σ_t^S). If the deposit interest rate is fixed and not fluctuating, then σ_t^D is zero. We assume that σ_t^D and σ_t^S are uncorrelated.

Table 3.1: Return–Risk Trade-Off for Households' Investments

	Return	Risk
Safer assets	r_t^D	σ_t^D
Startup businesses	r_t^S	σ_t^S

Source: Authors.

Table 3.1 shows the risk–return trade-off for households investments. If a household invests in safer assets (here: deposit), the return is r_t^D and the risk is σ_t^D, which we assume to be zero. If the household invests in startup projects that have a higher risk (σ_t^S) and expect a higher return (r_t^S), there is a trade-off between risk and return. It is assumed that $(\sigma_t^S)^2$ is larger than $(\sigma_t^D)^2$, that is to say, the risk of HIT funds is larger than the risk of deposits.

Next, in Equation (7) we look at the dynamic welfare function and two constraints presented in equations (7.1) and (7.2):

$$W = \int_0^{\infty} e^{-\theta t} \cdot U\left(r_t, \sigma_t\right) \tag{7}$$

$$s.t. \qquad r_t = \alpha_t r_t^D + (1-\alpha_t) r_t^S \tag{7.1}$$

$$\sigma_t^2 = \alpha_t^2 \left(\sigma_t^D\right)^2 + \left(1-\alpha_t\right)^2 \left(\sigma_t^S\right)^2 \tag{7.2}$$

In the next step, we develop the Hamiltonian and present it in Equation (8) with the utility function shown in parentheses:

$$\begin{aligned} H &= e^{-\theta t}\left(r_t - \beta\sigma_t^2\right) \\ &= e^{-\theta t}\left[\left\{\alpha_t r_t^D + \left(1-\alpha_t\right) r_t^S\right\} - \beta\left\{\alpha_t^2\left(\sigma_t^D\right)^2 + \left(1-\alpha_t\right)^2\left(\sigma_t^S\right)^2\right\}\right] \end{aligned} \tag{8}$$

where α_t is the ratio of allocation between deposits and HIT funds to startup projects. If α_t = 1, this means that households are putting all of their money in bank deposits. If α_t becomes smaller, then the ratio of investment in HITs for startups is increasing. In the next step, we maximize the Hamiltonian with respect to α_t, and write it for the α_t result in Equation (9).

Equation (9) shows the α_t obtained from Hamiltonian maximization:

$$\alpha_t = \frac{\left(r_t^D - r_t^S\right) + 2\beta\left(\sigma_t^S\right)^2}{2\beta\left[\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2\right]} \tag{9}$$

We can rewrite Equation (9) by dividing the numerator and denominator by 2β, and write Equation (10) as follows:

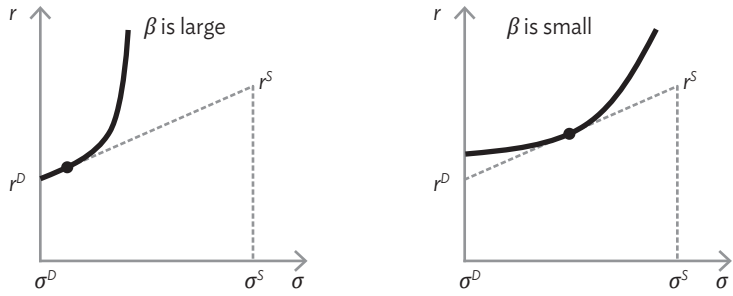
$$\alpha_t = \frac{\frac{1}{2\beta}\left(r_t^D - r_t^S\right) + \left(\sigma_t^S\right)^2}{\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2} \tag{10}$$

Equation (11) shows how α_t changes with respect to β:

$$\frac{\partial \alpha_t}{\partial \beta} = -\frac{1}{2\beta^2} \cdot \frac{\overset{(-)}{\left(r_t^D - r_t^S\right)}}{\underset{(+)}{\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2}} > 0 \tag{11}$$

Equation (11) shows that, if the weight of the risk (β) increases or if households become more risk-averse and seek safer types of assets, α_t (the share of bank deposits in total assets) will increase and households will invest less in HIT funds for startup projects.

Figure 3.3: Utility Functions with Regard to Different Risk Preferences



Source: Authors.

Figure 3.3 shows two cases of utility functions with regard to two different levels of risk preferences. On the left side, β is large, meaning that households are very concerned about risk and are risk-averse. Therefore, they prefer safer assets and deposit a major part of their assets in banks that have zero risk in this example, and a smaller amount in HIT funds for investing in startups that have higher risk and have

higher returns. On the right side, β is small, meaning that these households are risk-takers. Thus, the utility function becomes flatter than in the first case. Hence, they are investing a significant portion of their assets in HIT funds that give them r^S return but are associated with σ^S risk.

Equation (12) shows how α_t changes when the deposit interest rate $\left(r_t^D\right)$ also goes up:

$$\frac{\partial \alpha_t}{\partial r_t^D} = \frac{\frac{1}{2\beta}}{\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2} > 0 \tag{12}$$

Equation (12) shows that, if the deposit interest rate goes up, α_t (the share of savings in bank deposits) also goes up.

$$\frac{\partial \alpha_t}{\partial r_t^S} = \frac{-\frac{1}{2\beta}}{\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2} < 0 \tag{13}$$

Equation (13) shows that, if the rate of return on HIT funds for startups $\left(r_t^S\right)$ increases, the share of investments in deposits (α_t) will decrease. This means that households will be reluctant to put their money in bank deposits and will instead be more interested in investing in HIT funds for startup projects.

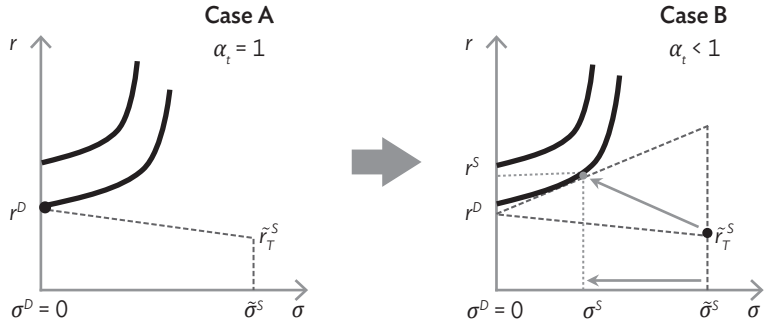
$$\frac{\partial \alpha_t}{\partial \left(\sigma_t^S\right)^2} = \frac{\frac{-1}{2\beta}\left(r_t^D - r_t^S\right) + \left[\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2\right]}{\left[\left(\sigma_t^D\right)^2 + \left(\sigma_t^S\right)^2\right]^2} > 0 \tag{14}$$

Equation (14) shows that, if the risk of investing in HIT funds for startups goes up, the share of investments in deposits (α_t) increases.

Figure 3.4 graphically summarizes the mathematical equations presented in this subsection by showing households' investment preference functions in two different cases. The households' utility function depends on the rate of return and risk represented by r and σ, as typical in finance theory. Figure 3.4 displays two different cases. In Case A, households have two choices for investment: investing in startups or saving in the form of bank deposits. However, it is very difficult for households to recognize which startups have a higher probability of success, as there are no tools that enable this evaluation. In this case, α_t = 1, households prefer to invest their assets in the form of bank deposits, because it is not rational to invest in a sector

whose risk cannot be assessed. In Case B, DLT-based HIT funds enable households to trace their investment in startups, creating transparency and trust. Moreover, the existence of the CRDS makes it possible to recognize startups with a higher probability of success, in addition to the existence of marketing and sales features that help startups improve their businesses, therefore boosting the probability of success, rate of return, and trust of investors. As a result, households prefer to invest all or a portion of their assets in these startups, and invest less in bank deposits.

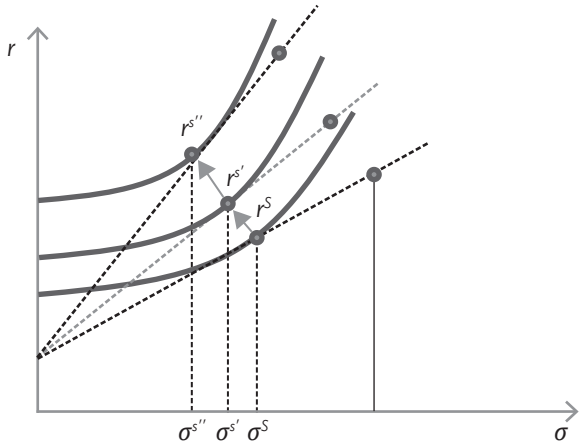
Figure 3.4: Changes in Households' Investment Preferences by Improving the Ecosystem of Startup Businesses



Source: Authors.

As mentioned above, introducing DLT-based HIT funds and establishing a CRDS to accumulate big data on the credit history of individuals and to act as the credit assessor and evaluator of startup projects will increase the startups' rate of return. Only startups with a higher credit score and better rate of return will be introduced to investors (namely, households). In addition, DLT is bringing transparency and trust to HIT funds and investors, and reduces the risk involved. Hence, as made clear in Figure 3.5, the risk of investment in HIT funds thanks to DLT will be reduced from σ^S to $\sigma^{s'}$ and $\sigma^{s''}$. In addition, due to the role of the CRDS, the rate of return on HIT funds will increase from r^S to $r^{s'}$; a more efficient CRDS and better assessment can increase this even further to $r^{s''}$. This will make households more eager to invest in startup projects instead of keeping money in bank deposits.

Figure 3.5: Increase in Rates of Return and Reduction of Risk from the Introduction of Distributed Ledger Technology-Based Hometown Investment Trust Funds and a Credit Risk Database for Startups



Source: Taghizadeh-Hesary and Yoshino (2019).

3.5 Concluding Remarks

Startups are known to introduce new products and services that in most cases create new value in the economy. Startups create completely new ways of doing business in most economies, and knowledge-based startups can play a significant role in introducing new technologies and contribute to technological progress. In addition, startups in many economies contribute significantly to job creation and economic growth and have played an important role in the fourth industrial revolution. However, although startups are crucial players in the economy, they face significant challenges to their development and growth, including the difficulty of accessing finance and investment, as well as marketing and selling their products and services. In the bank-dominated financial system that exists in most Asian economies, and due to Basel capital requirements that restrict lending to risky sectors, banks are not a suitable source of financing for startups. Hence it is necessary to look for nonbank solutions. To ensure the flow of investment from the private sector to startups, and to reduce the risk and increase the rate of return of these projects, investments must be made more transparent.

This chapter delineates the integration of DLTs into the current HIT funds framework with the aim of improving the funding aspect of the startup ecosystem. The model reveals the investor's decision problem and impacting factors. Integrating DLTs can make HIT funds more transparent and reduce the associated risk, resulting in a higher share of investments in startup projects, as shown by the theoretical model provided here. More transparent HIT funds are more likely to be adopted since the associated risk for investors is reduced. This may help expand the investor pool to individuals from local and domestic contexts, or from countries other than the one in which the project is realized. Integrating DLT with HIT funds facilitates direct and fully transparent investments between partners who would not previously have collaborated, and brings together individual investors from different countries to invest in specific startup companies in the private sector. If projects are conducted properly and well received by individual investors, their credit rating will increase and it will become easier for them to receive other loans from classical financial institutions.

However, to implement this successfully, it is essential to create a necessary function to assess the credibility of the project. This chapter proposes the introduction of a CRDS. Although a CRD for SMEs exists in Japan, SMEs have a credit history, which makes assessing their credit risk a much easier, backward-looking process. However, as startups often lack a history of activity, their assessment is more forward looking and must be based on an evaluation of the feasibility of the project, managerial skills, marketing and sales plans, and other qualitative criteria. In addition, it is crucial to assess the credit history of the startup founders. As a result, only startups with a higher score (e.g., better credit history of the founders, a higher probability of success of the project, and a better rate of return) will be introduced to potential investors. Reducing risk as a result of the DLT and increasing the rate of return and probability of success will expand the investment pool for startups. In addition, instead of saving money in the form of bank deposits or buying government bonds with very low interest rates, households will be more interested in investing in startups through HIT funds. Finally, in addition to financing challenges, most startups are facing difficulties with marketing and sales. This chapter proposes a form of internet-based marketing similar to the platform used in Japan and many other countries that could improve the startup ecosystem overall.

References

Asian Development Bank (ADB). 2015. *Asia SME Finance Monitor 2014.* Manila: ADB.

Angilella, S., and S. Mazzù. 2015. The Financing of Innovative SMEs: A Multicriteria Credit Rating Model. *European Journal of Operational Research.* 244(2): 540–554.

CB Insights. 2018a. https://s3.amazonaws.com/cbi-research-portal-uploads/2017/10/03140919/1uni.png (accessed 19 December 2018).

———. 2018b. https://www.cbinsights.com/research-unicorn-companies (accessed 19 December 2018).

Christidis, K., and M. Devetsikiotis. 2016. Blockchains and Smart Contracts for the Internet of Things. *IEEE Access.* 4: 2292–2303.

Davila, A., G. Foster, and M. Gupta. 2003. Venture Capital Financing and the Growth of Startup Firms. *Journal of Business Venturing.* 18(6): 689–708.

Decker, R., J. Haltiwanger, R. Jarmin, and J. Miranda. 2014. The Role of Entrepreneurship in US Job Creation and Economic Dynamism. *Journal of Economic Perspectives.* 28(3): 3–24.

Fernandes, G.B., and R. Artes. 2016. Spatial Dependence in Credit Risk and its Improvement in Credit Scoring. *European Journal of Operational Research.* 249(2): 517–524.

Haltiwanger, J. 2012. Job Creation and Firm Dynamics in the U.S. In *Innovation Policy and the Economy*, edited by J. Lerner and S. Stern, pp. 17–38. Chicago: National Bureau of Economic Research; Chicago Press.

Haltiwanger, J., R. S. Jarmin, and J. Miranda. 2013. Who Creates Jobs? Small vs. Large vs. Young. *Review of Economics and Statistics.* 95(2): 347–361.

Hanl, A. 2018. *Some Insights into the Development of Cryptocurrencies*. Technical Report, Joint Discussion Paper Series in Economics.

Hertig, A. 2018. First Bitcoin Smart Contracts Sidechain Now Secured by 1 in 10 Miners. https://www.coindesk.com/first-bitcoin-smart-contracts-sidechain-now-secured-1-10-miners/ (accessed 15 August 2018).

Hirsch, J., and U. Walz. 2018. The Financing Dynamics of Newly Founded Firms. *Journal of Banking and Finance*.

IOTA Foundation. 2017. The IOTA Foundation. https://www.iota.org/the-foundation/the-iota-foundation (accessed 15 August 2018).

Kane, T. 2010. The Importance of Startups in Job Creation and Job Destruction. *Kauffman Foundation Research Series*. Kansas City: The Kauffman Foundation of Entrepreneurship. https://www.kauffman.org/-/media/kauffman_org/research-reports-and-covers/2010/07/firm_formation_importance_of_startups.pdf (accessed 20 February 2019).

Kuwahara, S., N. Yoshino, F. Taghizadeh-Hesary, and M. Sagara. 2016. Role of the Credit Risk Database in Developing SMEs in Japan: Ideas for Asia. In *SMEs in Developing Asia: New Approaches to Overcoming Market Failures*, edited by P. Vandenberg, P. Chantapacdepong, and N. Yoshino. Tokyo: Asian Development Bank Institute.

Manson, J. 2017. Why Blockchain Will Revolutionize the Banking Industry. https://bravenewcoin.com/news/why-blockchain-will-revolutionize-the-banking-industry/ (accessed 25 July 2018).

Nelson, D., and G. Shrimali. 2014. Currency Exchange Risks in Renewable Energy Financing. *Energetica India.* September–October.

O'Dwyer, K. J., and D. Malone. 2014. Bitcoin Mining and Its Energy Footprint. In *ISSC '14: Proceedings of the 25th IET Irish Signals and Systems Conference*. Limerick: Department of Electronic and Computer Engineering, University of Limerick.

Park, K. 2018. Blockchain Is About to Revolutionize the Shipping Industry. https://www.bloomberg.com/news/articles/2018-04-18/drowning-in-a-sea-of-paper-world-s-biggest-ships-seek-a-way-out (accessed 25 July 2018).

Poon, W. P. H., M. Firth, and H. G. Fung. 1999. A Multivariate Analysis of the Determinants of Moody's Bank Financial Strength Ratings. *Journal of International Financial Markets, Institutions and Money.* 9: 267–283.

Popov, S. 2016. The Tangle. https://iota.org/ (accessed 20 January 2019).

Ravi Kumar, P. and V. Ravi. 2007. Bankruptcy Prediction in Banks and Firms via Statistical and Intelligent Techniques—A Review. *European Journal of Operational Research.* 180(1): 1–28.

Rottmann, R. 2018. About Smart Contracts in IOTA. https://medium.com/@ralf/about-smart-contracts-in-iota-626d2bd3619e (accessed 25 July 2018).

Silvia, A., and S. Mazzù. 2015. The Financing of Innovative SMEs: A Multicriteria Credit Rating Model. *European Journal of Operational Research.* 244(2): 540–554. https://doi.org/10.1016/j.ejor.2015.01.033 (accessed 25 January 2019).

Swami, A. 2018. Blockchain Technology Can Revolutionize the World-Wide Supply Chains Says FedX CEO. https://ambcrypto.com/blockchain-technology-revolutionize-worldwide-supply-chains-fedx-ceo/ (accessed 27 July 2018).

Taghizadeh-Hesary, F. and N. Yoshino. 2019. The Way to Induce Private Participation in Green Finance and Investment. *Finance Research Letters.* https://doi.org/10.1016/j.frl.2019.04.016 (accessed 12 April 2019).

Tapscott, A., and D. Tapscott. 2017. How Blockchain Is Changing Finance. https://hbr.org/2017/03/how-blockchain-is-changing-finance (accessed 27 July 2018).

Tripathi, N., P. Seppänen, G. Boominathan, M. Oivo, and K. Liukkunen. 2019. Insights into Startup Ecosystems Through Exploration of Multi-Vocal Literature. *Information and Software Technology.* 105: 56–77. https://doi.org/10.1016/j.infsof.2018.08.005 (accessed 10 February 2019).

Vukolic, M. 2015. The Quest for Scalable Blockchain Fabric: Proof-of-Work vs. BFT Replication. In *International Workshop on Open Problems in Network Security*. pp. 112–125. Zurich: Springer.

Yoshino, N., and S. Kaji. 2013. *Hometown Investment Trust Fund.* Tokyo: Springer.

Yoshino, N., and F. Taghizadeh-Hesary. 2014. Analytical Framework on Credit Risks for Financing Small and Medium-Sized Enterprises in Asia. *Asia-Pacific Development Journal.* 21: 1–21.

———. 2015. Analysis of Credit Risk for Small and Medium-Sized Enterprises: Evidence from Asia. *Asian Development Review.* 32(2): 18–37.

———. 2017. Alternatives to Bank Finance: Role of Carbon Tax and Hometown Investment Trust Funds in Developing Green Energy Projects in Asia. ADBI Working Paper 761. Tokyo: ADBI.

———. 2018. Alternatives to Private Finance: Role of Fiscal Policy Reforms and Energy Taxation in Development of Renewable Energy Projects. *Financing for Low-Carbon Energy Transition*. pp. 335–357. Tokyo: Springer.

Yoshino, N., F. Taghizadeh-Hesary, and F. Nili. 2015. Estimating Dual Deposit Insurance Premium Rates and Forecasting Non-Performing Loans: Two New Models. ADBI Working Paper 510. Tokyo: ADBI.

Yoshino, N., F. Taghizadeh-Hesary, and M. Nakahigashi. 2019. Modelling the Social Funding and Spill-Over Tax for Addressing the Green Energy Financing Gap. *Economic Modelling* 77: 34–41.

Yoshino, N., T. Schloesser, and F. Taghizadeh-Hesary. 2018. Social Funding of Green Financing: An Application of Distributed Ledger Technologies. ADBI Working Paper 889. Tokyo: ADBI.

Credit Risk Reduction Effect on SME Finance through the Use of Bank Account Information

NAOKO NEMOTO AND NAOYUKI YOSHINO
Asian Development Bank Institute

YUTAKA OHKUBO, DAIMEI INABA, AND KENTARO YANAGISAWA
Risk Data Bank of Japan

4.1 Introduction

The growth of small and medium-sized enterprises (SMEs) is a critical issue for the economic development of Japan and other Asian countries. SMEs rely on bank loans for their external financing, but they sometimes have difficulties in obtaining enough funds from banks in a timely manner. This chapter examines whether the use of bank account information, such as information on deposits and withdrawals, which has not been fully accounted for in loans of Japanese banks to SMEs, can enhance the accuracy of credit risk measurements.

SMEs play an important role in the development of Japan's economy and account for about 40% of Japan's total gross domestic product (GDP) and 74% of all employers. Japanese companies mainly rely on indirect financing by banks, but the trend is even stronger for SMEs, and banks make up much of external borrowing. The lending volume of national banks for SMEs was ¥248 trillion in 1998. The figure has since declined but has been recovering since 2012 and remained at ¥212 trillion as of the end of 2017. Bank lending as a proportion of lending also declined from 49.3% in 1998 to 42.0% in 2016.

The lack of public information on SMEs' corporate activities compared with large enterprises and the large asymmetry of information between borrowers and lenders make it difficult for banks to manage the credit risk of SMEs (Yoshino and Yamagami 2017). Therefore, there is a tendency to rely on collateral, such as real estate, personal assets, and the guarantees of chief executive officers or CEOs rather than judging the creditworthiness of the company itself (Financial Services Agency 2003).

Small companies also tend to rely on their own funds, funds from acquaintances, and public funds, etc. without depending on banks (SMEA 2015; Yamori 2003).

Analysis of the creditworthiness of SMEs by banks has made much progress since the bad loan problems of the 1990s. One example is the implementation of the internal credit rating system that ranks companies according to financial strength. In addition to major financial indicators, such as the capital adequacy ratio, there are cases where qualitative factors, such as management's abilities and financial transparency, are also considered. Also, since the 2000s, the financial scoring model has become pervasive (Financial Services Agency 2003). Scoring is a lending model constructed by statistical methods that estimates the probability of bankruptcy of loan claims and uses the probability to determine loan extension and loan rate spreads. The scoring method does not manage risks on a case-by-case basis but manages the risks on loans throughout the portfolio control based on the law of large numbers. Therefore, the accuracy tends to increase as the data pool becomes larger, so the construction of the database is important. The Japan Risk Data Bank (RDB),[1] comprising major banks and regional banks, was established in 2000 as the first data consortium in Japan. In 2001, the SME Credit Risk Information Database (CRD)[2] was established under the initiative of the Ministry of Economy, Trade and Industry and the Small and Medium Enterprise Agency (SMEA). These data are used for loan reviews, interest rate setting, and portfolio management, among others, and have contributed to the advancement of credit risk analysis by banks.

On the other hand, there are limits to internal ratings and scoring by banks (Hirata 2005). First, in many cases, there are problems with the quality of the financial statements of SMEs. According to a survey by the SMEA, only about 30% of firms are considering preparing accounts based on appropriate accounting for strengthening financing capability (SMEA 2003). Second, there is a time lag of information. There have been many cases where the latest financial statements for the settlement dates acquired for examination were from 3–15 months ago, so the current state of the companies was unclear. In addition, monitoring after financing is insufficient.

1 The Japan Risk Data Bank (RDB) has more than 60 financial institutions, such as major Japanese banks and regional banks, as members and shares the credit risk information of 910,000 client companies anonymously. In addition to financial information, operational risk information and bank account dynamics information, etc. are also gathered.

2 About 170 financial institutions, including credit unions, are members of the SME Credit Risk Information Database (CRD) and share credit risk information on about 2.4 million credit companies anonymously. The average size of SMEs is slightly smaller than in the RDB.

With financial statements alone, banks have difficulty grasping the situations of its clients, which can change daily throughout the fiscal year.

To solve these problems, banks can detect the window dressing of accounts by interviewing and researching changes in the business environment after the settlement date to counteract the weaknesses of ratings and scoring. However, under prolonged monetary easing, the profitability of financial institutions has deteriorated, and efficient management is required now more than ever. Financial technology (fintech) companies that provide loans to individuals and SMEs quickly and easily via personal computers and mobile phones are also entering the market. Under such an environment, it is getting harder for banks to continue traditional labor-intensive lending.

Utilizing bank account information, as considered in this chapter, could increase the ability of banks to analyze the credit risk of SMEs and contribute to reductions in the time and costs required for review. In Japan, most money transfers and settlements, which are the result of corporate activity, are done through bank accounts, and "account history information" contains abundant information on businesses—specifically, deposit account withdrawal information, inward and outward remittance data, bills for collection, discounted commercial bills, electronically recorded monetary claims, and loan execution collection details, etc. By continuously monitoring these data, it is possible to continuously capture the actual business situation of clients over time and predict changes in their credit situations.

Numerous academic studies have proved that SMEs can be ranked by credit risk using models that use corporate financial data or bank lending data, such as delinquency conditions (Behr, Guttler, and Plattner 2004; Yoshino and Taghizadeh-Hesary 2014). There are also several empirical studies on the changes in the accuracy of the model depending on the choice of variables and whether to incorporate qualitative information when constructing the credit risk model. However, although the importance of bank account information is recognized in banking practices, research that testifies the validity of bank account information has been rare. The contribution of this chapter is to show empirical analysis of bank account information that utilizes a large pool of both financial and bank account information (big data) held by the RDB.

This chapter demonstrates that the accuracy of default prediction improves when a model based on bank account information is used in addition to the default prediction model based on traditional financial information. Improvement tends to increase when the size of a company is small. If the size of the company is small, the quality of financial data is generally assumed to be low, but the bank account

information model can complement this. In addition, for small firms, the bank account information model shows better default prediction compared with the financial model, which implies the possibility that banks could extend loans even if only the bank account information is available. The correlation coefficients of the financial model and the bank account model are higher than 50% but not very high, suggesting these models evaluate borrowers from different perspectives.

If the utilization of the bank account information model spreads, banks can reduce their credit costs and reviews time and costs and lend to SMEs more efficiently. The empirical analysis in this chapter is targeted at SMEs in Japan, but the results could also be relevant for other countries, particularly for the emerging countries in Asia.

SMEs in Asian countries have not obtained enough funds for growth. According to a survey by the International Finance Corporation, the supply shortage of loans to SMEs as of the end of 2014 was $706 billion for East Asia and $2,060 billion for South Asia. In Asia, the loan balance for SMEs accounts for 19% of bank loans overall, which is lower than in other regions. SMEs do not seek bank loans because of collateral requirements, complicated application procedures, bank lending conditions not meeting their needs, and high loan interest rates, among others (ADB 2015). The asymmetry of information is large, especially in low-income countries, and the quality of the financial information on SMEs is low and many are not audited.

Regarding a common database, there are public credit information agencies in 8 of the 20 member-countries of the Asian Development Bank (ADB). Information collected by credit information agencies includes (i) information on business; (ii) information on bank transactions, including default information; and (iii) information on firms' financial situation. However, companies that do not have bank transactions do not have information on business and bank transactions, and the information provided by member banks is not accurate and credible enough in many cases. Thus, it appears that banks use this information only for supplementary purposes when lending. In most countries, there have been no solid systems for banks to share or provide credit risk information, such as the estimated default rates of companies like the RDB.

In Asia, the proportion of companies receiving bank loans is as small as 15.4% for small companies, but 79.4% have bank accounts and use bank accounts for settlements, etc. (ADB 2015). If bank account information were to be used systematically, we could expect the expansion of loans for SMEs.

The structure of this chapter is as follows: section 4.2 looks at the findings of previous research and section 4.3 shows the theoretical background. Section 4.4 explains the credit risk prediction method; the variables of the respective models using financial information, bank account information, and both methods together; and the results of the constructed credit models. Section 4.5 shows verification of the credit risk models in terms of the default prediction ability, and section 4.6 concludes. The Appendix supplements the explanation of the methods used for verification.

4.2 Literature Review

Many studies, inside and outside Japan, introduce credit risk models for SMEs. Most of them demonstrate that credit risk models utilizing financial statements appear to be useful in differentiating SMEs according to their credit risk and, thus, in banks' loan decisions (Behr, Guttler, and Plattner 2004; Yoshino and Taghizadeh-Hesary 2014). Behr, Guttler, and Plattner (2004) quantify the credit risk of German SMEs based on a logistic regression model. The variables selected in their model are mainly the financial statements of SMEs (e.g., the equity ratio) but the model also incorporates qualitative features of companies, such as location, corporate structure, and line of business. The default probability of large firms estimated by this model shows a high correspondence with the credit ratings disclosed on them by global credit rating agencies. Also, the accuracy ratio (see Appendix) for the credit scores estimated by this model is higher than 80, which proves that the model has a good prediction ability. Since the information on the firms tends to be concentrated on major banks in Germany, thereby hindering the diversification of the funding channels and, thus, the growth of SMEs (the hold-up problem[3]), another advantage of the scoring model would be that it could mitigate this problem. By providing an objective benchmark, the scoring model could eventually contribute to the diversification of the funding channels of SMEs.

Grunert, Norden, and Weber (2005) demonstrate that the combination of a firm's quantitative and qualitative information, such as on management efficiency, results in a mild increase in the model's default prediction ability. Similarly, a model by Anzai (2015) incorporates qualitative information on technology levels. It introduces a

[3] The hold-up problem is a situation where two parties may be able to work most efficiently by cooperating but refrain from doing so because of concerns that they may give the other party increased bargaining power, and thereby reduce their own profits. The hold-up problem leads to underinvestment.

technology level index for SMEs and shows that firms with a high level of technology can relatively swiftly recover from the downturn of profitability. This implies a correlation between SMEs' financial statements and their business competitiveness. On the other hand, Hergen and Wahrenburg (2003) point out that the model's estimation ability can be improved enough to overcome the limitations from the lack of qualitative information when the data pool covers vast amounts of quantitative information from many banks.

Although most of the studies on the credit risk model focus on the case of advanced countries, a few studies cover SME finance in emerging countries. Yoshino and Taghizadeh-Hesary (2014) examine the effectiveness of credit risk assessments of Iranian companies based on financial statements held by banks. More specifically, they present a model estimating the default probabilities of SMEs, with the relevant variables selected through principal component analysis and cluster analysis (clustering). The results of the study indicate that banks can classify SMEs according to their credit risk based on the financial statements held by banks, and this can be used in loan decisions and the pricing of loan rates. The study also emphasizes the importance of a corporate credit information database. Similarly, Yoshino et al. (2016) develop a model for assessing the default probability of SME lending in Thailand through principal component analysis. Based on a database of SME lending provided by the public credit information agency of Thailand, the model classifies SMEs according to their estimated default probability.

On the other hand, there are studies pointing out the limitations and room for improvement of the scoring model while admitting the effectiveness of the approach itself. Hirata (2005) examines the advantages and the disadvantages of the scoring model. For its advantages, the study mentions that (i) banks can streamline the troublesome process of loan examination in SME lending; (ii) by quantifying risk, banks can monitor the quality of portfolios as a whole, which can also be used in new customer acquisition; and (iii) the scoring model supports market-based finance as it makes securitization easier. On the other hand, the chapter points out the disadvantages of the scoring model that (i) there will be sample selection bias since the model covers only the information of firms that applied for bank loans; (ii) the accuracy of the model is limited due to the low quality of SMEs' financial statements; (iii) the model does not necessarily guarantee more efficiency since it often requires an additional process, such as in-person interviews, due to the imperfect information.

This chapter builds a credit risk model based on financial statements as well as a model based on bank account information, such as the change in deposits or the level of deposits and loans compared with sales. In building the credit risk model, the chapter

refers to the methodology used in Yoshino and Taghizadeh-Hesary (2014) and Yoshino et al. (2016). Then, it examines the accuracy of the default prediction of the models. The results indicate that the accuracy of the default prediction of the model based on financial statements is improved when combined with the model based on bank account information. Especially for micro-sized firms that are generally assumed to have low-quality financial statements, the model tends to show a large degree of improvement of the default prediction accuracy. This implies that the model based on bank account information could mitigate the information quality issue. We also find that the creditworthiness predicted by each model is correlated with each other and that the accuracy of default prediction by the model based only on dynamic bank account information is comparable to the model based on financial statements in some cases. Bank account information could reveal the actual condition of a firm's cash flow, and its time lag is much shorter than financial statements, which makes it a good complement to financial statements of low quality. Moreover, it can reduce sample selection bias since it also contains information of firms without bank loans.

Many studies have indicated that the accuracy of the credit risk model depends on the selection of the variables. However, the effectiveness of the utilization of dynamic bank account information has not been examined before this chapter, despite the growing perception of its importance among bankers and financiers. Another new contribution of this chapter is that it utilizes big data derived from the RDB's database, which collects both financial and bank account information from Japanese banks. In addition, this chapter applies principal component analysis, which has the advantage of reducing multidimensional data sets to lower dimensions of analysis while minimizing the loss of information. Principal component analysis also ensures objective and quantitative assessment in selecting variables.

4.3 Theoretical Background

Before delving into an empirical analysis of credit risk, here we describe the theoretical background regarding the relationship between a bank's profit maximization and the improvement of credit risk analysis. A bank's profit maximization behavior can be written as follows, where Π denotes the bank's profit.

$$Max\ \Pi = r_L(L)L - \rho(CRA, Z_i L)L - r_D D - C(L, D)$$

s.t. *kDeposit + Loan = Deposit + Capital*

Assumptions:

- $r_L(\cdot)$ denotes the loan rate, which is a function of the amount of the loan
- $\rho(\cdot)$ denotes the default risk, which is a function of the credit risk analysis (CRA), the information of individual company (Z_i), and the loan amount (L)
- r_D denotes the interest rate on the deposit (D)
- $C(\cdot)$ denotes the operating cost, which is a function of the loan (L) and the deposit (D)

For simplicity, the capital cost is abstracted from the model, and we assume that the bank uses all the deposits (D) in making loans (L). Also, instead of assuming perfect competition, we assume that banks are in oligopolistic competition; that is, the loan rate is not given but is determined by the supply and demand of the bank's loanable funds.

$$\Pi = r_L(L)\cdot L - \rho(L,Z)\cdot L - r_D(1-k)L - C(L,D) \tag{1}$$

$$\frac{\partial \Pi}{\partial L} = \left(\frac{\partial r_L}{\partial L}\cdot L + r_L\right) - \left(\frac{\partial \rho}{\partial L}\cdot L + \rho\right) - (1-k)r_D - \frac{\partial c}{\partial L} = 0 \tag{2}$$

$$L\cdot\left(\frac{\partial r_L}{\partial L} - \frac{\partial \rho}{\partial L}\right) = -r_L + (1-k)r_D + \frac{\partial c}{\partial L} + \rho \tag{3}$$

$$L = \frac{1}{\left(\frac{\partial r_L}{\partial L} - \frac{\partial \rho}{\partial L}\right)}\left(-r_L + (1-k)r_D + \frac{\partial c}{\partial L} + \rho\right) \tag{4}$$

$$r_L = -\frac{\partial r_L}{\partial L}\cdot L + \left(\frac{\partial \rho}{\partial L}\cdot L + \rho\right) + (1-k)r_D + \frac{\partial c}{\partial L} \tag{5}$$

Equation (1) is the profit function of the bank: the loan revenue deducted by the credit cost that occurs at the time of borrower's default, the funding cost of deposits, and the operating cost. The bank attempts to maximize its profit, which requires Equation (2) to hold true as a first-order condition. Equation (2) can be developed into Equation (4), keeping the left side as the loan (L). If the bank could reduce the default risk with the newly introduced credit risk analysis, the marginal default risk, $\partial\rho$, will decrease, and the bank loan (L) will increase. Also, if the credit risk analysis is conducted systematically and effectively, the marginal operating cost, ∂c, will also decrease, leading to an increase in the bank loan.

Equation (2) can also be developed into Equation (5), keeping the left side as the interest rate (r). If the bank can reduce the default risk with the newly introduced credit risk analysis, the marginal default risk, $\partial\rho$, will decrease. Also, if the credit risk analysis is conducted systematically and effectively, the marginal operating cost, ∂c, will also decrease, leading to a decrease in the interest rate, r. Therefore, other things being equal, the new methods of credit risk analysis introduced in this chapter could lead to an increase in the banks' SME loans and a decrease in interest rates.

4.4 Analysis of the SME Credit Risk Model

4.4.1 | Credit Risk Models Using Financial Information and Bank Account Information

For our analysis, we developed three credit risk models aimed at assessing the credit quality of companies: (i) a model using financial information, such as balance sheets and financial statements (financial model); (ii) a model using bank account information (bank account model); and (iii) a model using both financial information and bank account information (hybrid model).

We employed the following logistic regression model to develop the credit risk assessment model in this chapter. The logistic regression model was used by previous research (Behr, Guttler, and Plattner 2004) and for Japanese banks' credit risk models.

$$\ln\left(\frac{1-\rho}{\rho}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k$$

In this equation, $\ln(\cdot)$ is the natural logarithm; ρ is the probability of default; β_0 is the intercept; x_i, $i = 1, \cdots, k$ are financial (dynamic) indicators, which are explanatory variables; β_i, $i = 1, \cdots, k$ are coefficients; and k represents the number of indicators used. In developing the model, we assigned 1 to companies that defaulted and 0 to companies that did not default during the observation period. Then, we used these variables including x_i, $i = 1, \cdots, k$ and estimated β_i, $i = 0, \cdots, k$, using the maximum likelihood approach. In addition, the following s is called the "beta value", where the estimated values of the intercept and coefficients are $\hat{\beta}_i$, $i = 0, \cdots, k$.

$$s = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \ldots + \hat{\beta}_k x_k$$

The next step is to identify the variables. For this study, we followed Yoshino and Taghizadeh-Hesary (2014) and Yoshino et al. (2016), who employed principal component analysis for the credit risk model of SMEs. We applied component analysis to the financial data and bank account data and then selected the components that had eigenvalues of more than 1. Principal component analysis is a technique for simplifying and reducing multidimensional data sets to lower dimensions of analysis while minimizing the loss of information. This method has the additional advantage of being able to select variables using quantitative and nondiscretionary methods. Each component is designed to be uncorrelated so that multicollinearity issues are detected, and the prediction is reliable.

The principal component Z is shown by the following equations:

$$Z_1 = a_{11}x_1 + a_{12}x_2 + \ldots + a_{1p}x_p = \sum a_{1i}x_i ; \sum {a_{1i}}^2 = 1$$

$$Z_k = a_{k1}x_1 + a_{k2}x_2 + \ldots + a_{kp}x_p = \sum a_{ki}x_i ; \sum {a_{ki}}^2 = 1$$

Here, x is an indicator of the financial information and bank account information, a is the loading vector of the indicator, and k is the number of components. In creating the hybrid model, we applied principal component analysis for both the financial and bank account information and selected components with higher eigenvalues. As the hybrid model incorporates both financial and bank account information, the model is expected to a have higher default predictability compared to the model using only one factor.

4.4.2 | Characteristics of Financial Information and Bank Account Information

Financial information refers to financial statements consisting of a balance sheet and an income statement, which represent a brief picture of a company's operational performance and financial activities during a specific period. In general, Japanese financial institutions obtain the most recent financial information for multiple fiscal periods from their prospective corporate borrowers before loan approvals. Corporate financial statements are highly reliable because companies are required to prepare them pursuant to the accounting standards set forth by law. They also contain a great deal of information. However, financial statements are generally prepared only annually,[4] and financial institutions need to wait for another 3 months or so to obtain

[4] Some corporations, such as listed companies, are required by law to prepare quarterly financial reports. However, most SMEs prepare statutory financial statements only once a year in Japan.

such reports summarizing business results for the previous 12 months. Therefore, one could argue that banks may fail to identify changes in their customers' business conditions that might have occurred over around the past 15 months.

Bank account information refers to information related to deposit account balances, transaction amounts, outstanding loan balances, and loan extensions and collections. In the case of a company that has accounts with multiple banks, the information that each bank can obtain is only that of the company's account with that bank. If the bank is the main bank of the company and is used by the company for a significant share of its activities, it can grasp the overall status of the company's business because it can accumulate broader bank account information than other banks. In contrast, the bank account information is less useful if a bank has a weak business relationship with the target company and may even be useless for a bank with which the target company has no account.

For a financial institution that serves as the main bank for the target company, bank account information on the company has already been accumulated in its database, so acquisition costs are low, and the data is more up-to-date compared with financial information. As such, the institution could use them effectively in monitoring the target company's day-to-day changing status.

In our financial model, we use 77 financial indicators (Table 4.1). Previous research (Yanagisawa et al. 2007) used 91 financial indicators, from which we selected 82 indicators and omitted those with high proportions of zero value or values beyond the limits of 2.5% and 97.5%. Furthermore, we omitted indicators with absolute values to have consistency between the financial model and bank account model.

The bank account model uses the balances of liquid deposits, fixed deposits, and outstanding loans as well as the amount of inflows and outflows of liquid deposits. Checking and savings accounts are treated as liquid deposits, and term deposits are treated as fixed deposits. In addition, the sum of the liquid deposit balance and the fixed deposit balance is defined as the total deposit balance; the total deposit balance minus the outstanding loan balance is defined as the net deposit balance. For the use of the bank account model, 64 indicators are created in the form of ratios. To calculate the ratios, the numerators are the amounts of deposits, loans, and net deposits at the end of the month. Also used as numerators were the minimum and maximum amounts and the standard deviations in a certain period. The denominators are the total sales or loan amounts. The indicators include the percentage of growth and the reduction of deposits and loans.

Table 4.1: List of Financial Indicators

Indicators		
Cash ratio	Interval measure	Debt-to-equity ratio
Net debt turnover period	Net interest-bearing debt turnover period	Gross profit to interest and discount expense ratio
Cash plus marketable securities ratio	Interest burden to sales ratio	Net interest burden to sales
Interest coverage ratio	EBIT to interest and discount rate expense ratio	Cash to debt ratio
Cash flow to sales ratio	Cash flow to total assets ratio	Cash flow to total liabilities ratio
Cash flow to interest-bearing debt ratio	Cash flow to debt ratio	Credit interval
Cash flow to total expense ratio	Cash flow to operating cost	Value-added to sales ratio
Labor share	Capital investment efficiency	Depreciation costs/ ordinary earnings
Breakeven point ratio	Ordinary profit and loss ratio	Cash asset ratio
Working capital ratio	Quick (acid test) ratio	Working capital to sales ratio
Trade payables to trade receivables ratio	Equity ratio	Fixed assets to equity ratio
Fixed assets to long-term liabilities ratio	Leverage	Long-term debt ratio
Debt ratio	Equity to total asset ratio	Equity to total liabilities ratio
Capitalization rate	Debt to sales ratio	Quick ratio
Price book-value ratio	Working capital to total asset ratio	Gross profit to sales ratio
Sales, general, and administrative expenses to sales ratio	Earnings before interest and taxes to sales ratio	Ordinary income to sales ratio
Income before tax to sales ratio	Current income to sales ratio	Return on total assets
Earnings before interest and taxes to total assets ratio	Ordinary income to total assets ratio	Current income to total assets ratio
Return on assets	Unappropriated retained earnings to total assets ratio	Current ratio
Return on equity	Earnings before interest and taxes to equity ratio	Ordinary income to equity ratio
Current income to equity ratio	Cash and deposits/ short-term borrowings	Total asset turnover
Fixed asset turnover	Receivables turnover period	Inventory turnover period
Trade payable turnover period	Net interest-bearing debt to assets ratio	Reimbursement period
Interest-bearing debt to cash	Interest-bearing debt ratio	Debt to equity ratio
Earnings before interest depreciation and amortization to interest-bearing debt	Debt capacity ratio	Turnover period of interest-bearing debt

Source: Authors.

4.4.3 | Sample Data

The data for both financial and bank account information for this statistical analysis were provided by the RDB, one of the leading data consortiums in Japan. The study also covers data on loan classifications, which were assigned by RDB member banks for internal credit risk analysis. The base dates are set at the end of 2015 and 2016. We apply the credit scoring model to all companies and compare the status of those companies after 1 year to judge the accuracy of the credit scoring. The financial information is annual data submitted to member banks between June 2014 and September 2016. The bank account information is basically daily data from which we use 400 observation points in 1 December 2014–31 December 2016.[5] The study covers entities that meet all the following conditions:

(i) Nondefault status[6] as of 31 March 2015 or 31 March 2016 (referred to as the base dates)
(ii) Granted loans from the data-providing banks as of the base date
(iii) Can provide financial information for a period of 3–18 months before the base date
(iv) Can provide bank account information for a period of 13 months before the base date
(v) Sales below ¥10 billion[7]
(vi) Share of deposits at the bank[8] of above 50% but below 200%

5 We could collect more information if we were to extend the observation periods. On the other hand, longer periods mean higher costs for acquiring the data. Therefore, we choose 13 months as the period is not too long, and we can calculate the annual growth rate.

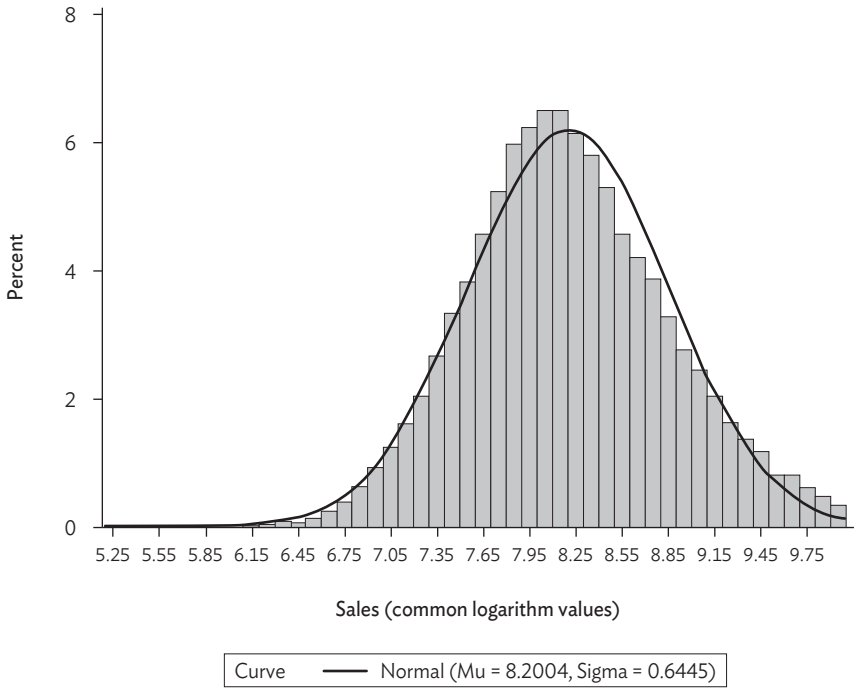
6 With respect to the classification of obligor status, we include firms lower than the category of "in danger of bankruptcy" under the Financial Restoration Law. This category is defined as those firms with a negative net worth or that are vulnerable to a change of environment. Under this standard, default includes obligors classified as "in danger of bankruptcy," "de facto bankrupt," and "bankrupt." We consider obligors classified as "normal (*seijo-saki*)," "need special attention," and "substandard" to be "nondefault."

7 This is because the focus of this study is SMEs.

8 The share of deposits represents the share of the target company's account for settlement at the data-providing bank. It is calculated by dividing the amount of "business-related" deposits for a period of 12 months before the end of the fiscal year by the total amount of sales in the financial statement for that period. Business-related deposits are the amounts deposited in the entity's account at the data-providing bank minus the amounts of deposits or withdrawals that are not directly related with business, such as loans granted, withdrawals of term deposits, and transfers within the entity, leaving only the transactions that are the related sales and payments of the entity. The higher the share of deposits or withdrawals, the more effectively the model functions.

The next section shows the default predictability of each model described in this section. The default observation period is defined as 1 year from the base date in that calculation. We classify companies that made full repayments of their loans to the data-providing bank during the observation period as nondefaulted as of the end of the fiscal term. To show the distribution of the sample data, Figure 4.1 shows the common logarithms of the sales of all companies used for the analysis. The median for sales is ¥150 million, and the peak of the distribution is around that point.

Figure 4.1: Distribution of Targeted Firm Sales



Notes: Total number = 42,654; default = 441; nondefault = 42,213.
Source: Authors' calculations.

In developing a credit risk assessment model, it is common to divide the target data into two sets, one for in-sample data and another for out-sample data. The model can then be created based on the in-sample data and applied to the out-sample data to check the validity of the model. We follow this approach in our analysis here, dividing the target data into two sets in a way that the number of defaults and the number of nondefaults in the in-sample data and the out-sample data become 1-to-1.[9] Table 4.2 shows the results of the default ratios of the target companies.

Table 4.2: Default Frequency Data

	Default Frequency Data			
	Total	Nondefault	Default	Default Ratio, %
In-sample data	21,328	21,107	221	1.04
Out-sample data	21,326	21,106	220	1.03
Total	42,654	42,213	441	1.03

Source: Authors' compilation.

The number in the "default" column indicates the number of companies that defaulted in the observation period, and the "nondefault" column shows the number of companies that did not default in the same period. Table 4.3 shows the sales comparisons for the data.

Table 4.3: Comparison of Sales for the In-Sample and Out-Sample Data

		Corporate Sales Amounts (¥ million)						
	Cases	Average	STD	25%	50%	75%	t-statistic	p-value
In-sample data	21,328	492	1,043	58	147	413	–0.04	0.9711
Out-sample data	21,326	492	1,048	58	145	418		
Total	42,654	492	1,045	58	146	415		

STD = standard deviation.

Source: Authors' compilation.

[9] To make sure that no large differences in the characteristics exist between the in-sample data and the out-sample data, we compared the sales of the two sets of data. The p-value in the t-test is sufficiently large, which confirms the absence of a big discrepancy between the average sales in the in-sample data and those in the out-sample data.

4.4.4 | Analysis Results

Using the data sets explained in sections 4.2 and 4.3, we develop (i) a financial model using the financial information of SMEs, (ii) a bank account model using the account information from data-providing banks, and (iii) a hybrid model using both financial and bank account information. The model development procedures are as follows:

(i) Set up the upper and lower limits for the indicators.[10]
(ii) Apply principal component analysis to the indicators and find components and eigenvalues of each component.
(iii) Select those factors accounting for more than 10% of the variance (eigenvalues are larger than 1), which are regarded as significant components for explaining the variance.
(iv) Develop the logistic model using factors as explanatory variables and find the estimated coefficients of the variables.

The results of the principal component analysis for the financial model are shown in Table 4.4, the bank account model results in Table 4.5, and the hybrid model in Table 4.6. The first process through the third process are performed on the overall data including the in-sample data and the out-sample data.

Table 4.4 shows that the first component with the highest eigenvalue has 22.6% variance, which means it explains 22.6% of the total variance of the financial ratios. Factors 1–16 are used for the financial model as they have eigenvalues higher than 1. Factors 1–11 are used for the bank account model, and factors 1–26 are used for the hybrid model. The cumulative variances of the models are 84.1%, 91.2%, and 86.9%, respectively, indicating that a large part of the total variance is explained by the components.

[10] In setting the upper and lower limits for each indicator, we replace large (small) values that could impair the estimation accuracy of coefficients of the logistic regression model with the upper (lower) limit. The lower limit is set at 2.5% and the upper limit is set at 97.5%.

Table 4.4: Results of Principal Component Analysis: Financial Information (Balance Sheets and Financial Statements)

Principal Component	Eigenvalue	Share of Variance (%)	Cumulative Variance (%)	Characteristics of Major Components
1	**17.37**	**22.6**	**22.6**	Reliance on borrowing, such as total assets/borrowings
2	**11.86**	**15.4**	**38.0**	Profitability measurement, including earnings versus expenses
3	**7.03**	**9.1**	**47.1**	Profitability and efficiency, such as breakeven point ratio
4	**5.78**	**7.5**	**54.6**	Liquidity at hand, such as total liquid deposits/total assets
5	**3.72**	**4.8**	**59.4**	Costs and expenses in comparison with sales
6	**3.22**	**4.2**	**63.6**	Ability to cover debt payment (earnings/interest expense)
7	**2.47**	**3.2**	**66.8**	
8	**2.09**	**2.7**	**69.5**	
9	**1.94**	**2.5**	**72.0**	
10	**1.71**	**2.2**	**74.3**	
11	**1.51**	**2.0**	**76.2**	
12	**1.38**	**1.8**	**78.0**	
13	**1.27**	**1.7**	**79.7**	
14	**1.18**	**1.5**	**81.2**	
15	**1.15**	**1.5**	**82.7**	
16	**1.11**	**1.4**	**84.1**	
17	0.99	1.3	85.4	
18	0.93	1.2	86.6	
19	0.86	1.1	87.7	
20	0.79	1.0	88.8	
21	0.70	0.9	89.7	
22	0.60	0.8	90.5	
23	0.56	0.7	91.2	
24	0.51	0.7	91.8	
25	0.48	0.6	92.5	
26	0.43	0.6	93.0	
27	0.42	0.5	93.6	
28	0.37	0.5	94.0	
29	0.34	0.4	94.5	
30	0.33	0.4	94.9	

Source: Authors' calculations.

Table 4.5: Results of Principal Component Analysis: Bank Account Information

Principal Components	Eigenvalue	Share of Variance (%)	Cumulative Variance (%)	Characteristics of Major Components
1	**24.73**	**38.6**	**38.6**	Total deposit amount versus sales, reflecting liquidity and cash flow
2	**11.99**	**18.7**	**57.4**	Total borrowings versus total sales
3	**5.16**	**8.1**	**65.4**	Combination of deposits/sales and loan/deposits
4	**4.19**	**6.5**	**72.0**	Total borrowings versus total deposits
5	**3.12**	**4.9**	**76.9**	Increase and decrease of loans
6	**2.28**	**3.6**	**80.4**	
7	**1.73**	**2.7**	**83.1**	
8	**1.49**	**2.3**	**85.5**	
9	**1.43**	**2.2**	**87.7**	
10	**1.22**	**1.9**	**89.6**	
11	**1.05**	**1.6**	**91.2**	
12	0.87	1.4	92.6	
13	0.60	0.9	93.5	
14	0.55	0.9	94.4	
15	0.45	0.7	95.1	
16	0.35	0.6	95.6	
17	0.31	0.5	96.1	
18	0.29	0.5	96.6	
19	0.27	0.4	97.0	
20	0.19	0.3	97.3	
21	0.18	0.3	97.6	
22	0.17	0.3	97.8	
23	0.16	0.3	98.1	
24	0.15	0.2	98.3	
25	0.14	0.2	98.5	
26	0.11	0.2	98.7	
27	0.11	0.2	98.9	
28	0.10	0.2	99.0	
29	0.08	0.1	99.2	
30	0.08	0.1	99.3	

Source: Authors' calculations.

Table 4.6: Results of Principal Component Analysis: Hybrid

Principal Component	Eigenvalue	Share of Variance (%)	Cumulative Variance (%)	Characteristics of Major Components
1	**32.26**	**22.9**	**22.9**	Deposits versus total sales (bank account)
2	**22.22**	**15.8**	**38.6**	Reliance on borrowings (financial and bank account)
3	**11.59**	**8.2**	**46.9**	Profitability, such as breakeven point (financial)
4	**7.28**	**5.2**	**52.0**	Capital adequacy (financial)
5	**5.53**	**3.9**	**55.9**	Total borrowings versus deposits (bank account)
6	**5.01**	**3.6**	**59.5**	Increase and decrease of deposits (bank account)
7	**4.33**	**3.1**	**62.6**	
8	**3.58**	**2.5**	**65.1**	
9	**3.13**	**2.2**	**67.3**	
10	**2.96**	**2.1**	**69.4**	
11	**2.43**	**1.7**	**71.1**	
12	**2.26**	**1.6**	**72.7**	
13	**2.24**	**1.6**	**74.3**	
14	**1.86**	**1.3**	**75.6**	
15	**1.80**	**1.3**	**76.9**	
16	**1.61**	**1.1**	**78.1**	
17	**1.53**	**1.1**	**79.1**	
18	**1.43**	**1.0**	**80.2**	
19	**1.39**	**1.0**	**81.1**	
20	**1.33**	**0.9**	**82.1**	
21	**1.28**	**0.9**	**83.0**	
22	**1.17**	**0.8**	**83.8**	
23	**1.14**	**0.8**	**84.6**	
24	**1.12**	**0.8**	**85.4**	
25	**1.08**	**0.8**	**86.2**	
26	**1.05**	**0.7**	**86.9**	
27	0.98	0.7	87.6	
28	0.96	0.7	88.3	
29	0.91	0.6	89.0	
30	0.86	0.6	89.6	

Source: Authors' calculations.

For the financial model, the main components have the following characteristics:

(i) The first component has variables that reflect the reliance on borrowing. For the first component, the variables with large loadings are the total assets divided by total borrowings, total assets divided by interest-bearing debt, and the capital ratios (capital/total assets).
(ii) The second component has variables that reflect profitability. For this component, the variables with large loadings are the indicators reflecting earnings versus expenses, such as the total expenses cash flow ratio and the ordinary income ratio. Other variables reflect total sales versus total borrowings (e.g., the interest-bearing debt turnover and the total sales borrowing ratio).
(iii) The third component has variables that also reflect profitability. For the third component, the variables with large loadings are the breakeven point ratio and the return on equity.
(iv) The fourth component has variables that reflect liquidity at hand. For the fourth component, the variables with large loadings are the total liquid deposits/total assets, the cash ratio, and the quick ratio. Total capital/total earnings also have a large loading, which implies that companies with high earnings tend to have good liquidity.
(v) The fifth component has variables that reflect costs and expenses compared with sales. For this component, the variables with large loadings are indicators such as operating expenses versus total sales and sales margins. They also include interest expense and discounted notes/gross profits and trade receivables turnover.
(vi) The sixth component has variables that reflect earnings capacity to cover debt payment. For this component, the variables with large loadings are indicators reflecting operating profits and earnings before interest, tax depreciation, and amortization (EBITDA) compared to interest expenses and interest-bearing debt.

For the bank account model, the main components have the following characteristics:

(i) The first component has variables that compare the total deposit amounts and total sales. The level of total deposits versus total sales reflects whether a company has enough liquidity to support business activities and can produce a stable cash flow.
(ii) For the second component, the variables with large loadings are the indicators reflecting total borrowings versus total sales. The higher total borrowing ratio means higher credit risk for the firm.
(iii) The third component has variables that are combinations of the deposit/total sales ratios and loan/deposit ratios. The deposit ratios include liquid deposits/total sales and the increase of total deposits/total sales.
(iv) For the fourth component, the variables with large loadings are indicators reflecting total borrowings compared with total deposits.
(v) The fifth component has variables that reflect the increase and decrease of loans. The variables with large loadings are the net increase of total loans/total sales and the increase of total loans compared to the level in the previous year.

For the hybrid model, which incorporates both financial and bank account information, the main components have the following characteristics:

(i) The first component has variables that reflect deposits versus total sales (bank account information).
(ii) The second component has variables that reflect reliance on borrowings. The variables with large loadings are the total loan amounts and a mixture of financial and bank account information.
(iii) The third component has variables that reflect profitability. The variables with large loadings are the breakeven point and return on equity ratios (financial information).
(iv) The fourth component has variables that reflect capital adequacy compared with total assets and cash flow (financial information).
(v) The fifth component has variables that reflect total borrowings compared to deposits (bank account information).
(vi) The sixth component has variables that reflect the increase and decrease of deposits (bank account information).

The first component, deposits versus total sales, has a 22.9% variance. Among the top six components, bank account information is included in four components, which indicates that bank account information is critical in predicting default.

Tables 4.7–4.9 show the results of the estimation of the coefficients of the logistic regression models based on selected components with eigenvalues of more than 1. The regression was run using the in-sample data. Table 4.7 shows the financial model; Table 4.8, the bank account information model; and Table 4.9, the hybrid model. In Table 4.7, the hypothesis that the coefficient is zero is rejected at the 1% level for 7 out of 16 components. In Table 4.9, the hypothesis that the coefficient is zero is rejected at the 1% level for 5 out of 11 components. In Table 4.9, the hypothesis that the coefficient is zero is rejected at the 1% level for 14 out of 26 components. These results all demonstrate the validity of the model.

Table 4.7: Results of Estimates: Financial Model (Balance Sheets and Financial Statements)

Variable	Estimated Coefficient	t-statistic	p-value
Intercept	5.7256	1,153.4066	0.0000
Component 1	0.3652	68.3285	0.0000
2	0.1112	11.2091	0.0008
3	–0.0181	0.2495	0.6174
4	0.2026	13.0828	0.0003
5	–0.1048	2.7642	0.0964
6	0.2678	7.6029	0.0058
7	–0.1060	2.8531	0.0912
8	0.1407	6.4802	0.0109
9	0.2534	23.9213	0.0000
10	0.1122	2.5644	0.1093
11	–0.1519	7.2368	0.0071
12	–0.0635	0.9261	0.3359
13	–0.0731	1.1677	0.2799
14	–0.0266	0.1864	0.6660
15	–0.2497	13.0188	0.0003
16	–0.0552	0.6541	0.4186
AIC	2,068.4000		
McFadden R2	0.1728		

AIC = Akaike information criterion.

Source: Authors' calculations.

Looking at the Akaike information criterion (AIC), the hybrid model has a lower AIC than the financial and bank account models. This shows that the hybrid model has a smaller prediction error compared to the other two models.

Table 4.8: Results of Estimates: Bank Account Model

Variable	Estimated Coefficient	t-statistic	p-value
Intercept	8.4585	264.0288	0.0000
Component 1	0.7818	98.1440	0.0000
2	–1.4290	55.8695	0.0000
3	–1.2847	42.7388	0.0000
4	2.6597	40.8866	0.0000
5	0.0696	2.1601	0.1416
6	0.1841	11.1913	0.0008
7	0.1363	4.1128	0.0426
8	0.1731	3.5690	0.0589
9	0.1272	0.3009	0.5833
10	0.1257	2.5162	0.1127
11	0.0098	0.0264	0.8709
AIC	2,461.5000		
McFadden R2	0.1329		

AIC = Akaike information criterion.

Source: Authors' calculations.

Table 4.9: Results of Hybrid Model

Variable	Estimated Coefficient	t-statistic
Intercept	7.5273	329.6084
Component 1	0.5122	76.3668
2	–0.6521	40.3171
3	0.1391	7.3013
4	0.2580	33.3141
5	1.1070	22.0717
6	0.5399	21.0513
7	–0.6395	26.0072
8	0.3601	12.7396
9	0.0538	1.0830
10	0.4075	17.3367
11	0.7058	17.0777
12	–0.2333	6.5708
13	–0.0460	0.8381
14	0.1398	3.5677
15	0.0421	0.3624
16	0.0787	1.2867
17	0.0135	0.0489
18	–0.2539	9.0493
19	–0.0930	1.6797
20	–0.2502	9.4903
21	0.1906	10.9591
22	–0.0149	0.0416
23	–0.1501	4.4251
24	–0.2931	9.2046
25	0.1472	2.4150
26	0.0542	0.7916
AIC	2,461.5000	
McFadden R2	0.2092	

AIC = Akaike information criterion.

Source: Authors' calculations.

4.5 Verification of the Credit Risk Model

To compare the default prediction abilities of each model, we measured the accuracy ratios (ARs) (see Appendix). The results are shown in Tables 4.10, 4.11, and 4.12. We also computed the ARs of each model by category and by the amount of sales and verified whether the quality of the discrimination of the model differed in terms of firm scale.

Table 4.10: Accuracy Ratios of the In-Sample Data

Group Segment	Total	Nondefault	Default	Default Ratio	Accuracy Ratio		
					Financial	Bank Account	Hybrid
A	2,680	2,643	37	1.4	67.6	63.2	71.8
B	5,634	5,557	77	1.4	67.6	67.9	74.4
C	6,329	6,259	70	1.1	72.3	62.1	77.0
D	6,685	6,648	37	0.6	74.6	69.6	79.9
Total	21,328	21,107	221	1.0	71.6	66.8	76.5

A = Less than ¥30 million, B = ¥30 million–¥100 million, C = ¥100 million–¥300 million, D = More than ¥300 million.

Note: "Financial" shows the results of the financial model using balance sheets and financial statements. "Bank account" shows the results of the bank account model. "Hybrid" shows the results of the hybrid model using both financial data and bank account data.

Source: Authors' calculations.

Table 4.11: Accuracy Ratios of the Out-Sample Data

Group Segment	Total	Nondefault	Default	Default Ratio Total	Accuracy Ratio		
					Nondefault	Default	Total
A	2,718	2,675	43	1.6	55.3	59.5	62.6
B	5,722	5,638	84	1.5	53.4	59.9	62.7
C	6,116	6,063	53	0.9	72.8	73.7	80.2
D	6,770	6,730	40	0.6	80.7	58.9	78.4
Total	21,326	21,106	220	1.0	65.1	64.6	71.4

A = Less than ¥30 million, B = ¥30 million–¥100 million, C = ¥100 million–¥300 million, D = More than ¥300 million.

Note: "Financial" shows the results of the financial model using balance sheets and financial statements. "Bank account" shows the results of the bank account model. "Hybrid" shows the results of the hybrid model using both financial data and bank account data.

Source: Authors' calculations.

Table 4.12: Accuracy Ratios of the Total Data

Group Segment	Total	Nondefault	Default	Default Ratio Total	Accuracy Ratio		
					Nondefault	Default	Total
A	5,398	5,318	80	1.5	61.0	61.2	66.9
B	11,356	11,195	161	1.4	60.2	63.7	68.2
C	12,445	12,322	123	1.0	72.6	67.1	78.4
D	13,455	13,378	77	0.6	77.8	64.0	79.2
Total	42,654	42,213	441	1.0	68.3	65.7	73.9

A = Less than ¥30 million, B = ¥30 million–¥100 million, C = ¥100 million–¥300 million, D = More than ¥300 million.

Note: "Financial" shows the results of the financial model using balance sheets and financial statements. "Bank account" shows the results of the bank account model. "Hybrid" shows the results of the hybrid model using both financial data and bank account data.

Source: Authors' calculations.

The following are evaluations that can be inferred from the results of the verification.

- The ARs tend to be lowest for the bank account model, followed by the financial model. The ARs for the hybrid model are the highest. The combination of financial and bank account information produces a model that has the strongest capability to detect defaults.
- The ARs of the out-sample data in the financial model are about 6.5 percentage points lower than the ARs of the in-sample data. The ARs of the out-sample data in the bank account model are about 2.2% lower than the ARs of the in-sample data. However, for both models, the ARs of the out-sample data are regarded as high at above 65% compared with other studies and results of rating agencies. Considering that the differences in the ARs for the in-sample data and the out-sample are not very large, and the absolute level of the ARs of the out-sample data is high, we can confirm the validity of the model created from the in-sample data.
- For those firms with sales less than ¥300 million, the ARs for the bank account model are higher than the ARs for the financial model. The ARs of the bank account model are highest in the category of companies with sales ranging from ¥100 million to ¥300 million. In addition, the improvements in the ARs, by adding the bank account information to the financial information, are higher for those categories with lower sales. This shows that the bank account information is useful for smaller firms, which tend to have lower quality financial statements.

For the next step, we derived the Pearson correlation coefficients between the financial model and the bank account model. The results are shown in Tables 4.13, 4.14, and 4.15 for the in-sample data, out-sample data, and the total data. The Pearson correlation coefficients of the financial model and the bank account model are about 51%. This suggests that both models are correlated, but the degree of correlation is not very high. This offers supporting evidence that the bank account model evaluates borrowers from a viewpoint different from that of the financial model. As a result, the credit discrimination capability may improve through the hybridization of the financial model and the dynamic model. Additionally, banks could expand their target area by adding the bank account information to the financial information.

Table 4.13: Pearson Correlations: In-Sample Data

	Pearson Correlations		
	Financial	Bank Account	Hybrid
Financial model	1.0000	0.5637	0.8377
Bank account model	0.5637	1.0000	0.8882
Hybrid model	0.8377	0.8882	1.0000

Source: Authors' calculations.

Table 4.14: Pearson Correlations: Out-Sample Data

	Pearson Correlations		
	Financial	Bank Account	Hybrid
Financial model	1.0000	0.5655	0.8385
Bank account model	0.5655	1.0000	0.8888
Hybrid model	0.8385	0.8888	1.0000

Source: Authors' calculations.

Table 4.15: Pearson Correlations: Total

	Pearson Correlations		
	Financial	Bank Account	Hybrid
Financial model	1.0000	0.5646	0.8381
Bank account model	0.5646	1.0000	0.8885
Hybrid model	0.8381	0.8885	1.0000

Source: Authors' calculations.

Overall, the analysis confirms that the accuracy of default prediction improves when a model based on bank account information is used in addition to the default prediction model based on traditional financial information. The analysis shows that the degree of improvement increases when the company is small, and the effect is significant for companies with less than ¥300 million in annual sales. For small companies, the quality of financial data is generally assumed to be low, but the bank account information model can complement the incomplete data. Also, for small firms, the bank account model has a higher default prediction ability than the financial model.

For the hybrid model, which incorporates both financial and bank account information, the main components are (i) the deposit amount versus total sales, (ii) the loan amount versus total sales, (iii) the indicators showing profitability, (iv) the capital ratios, (v) the loan amount compared to deposits, and (vi) the increase and decrease of deposits. Among the six major components, four are derived from the bank account information, which offers supporting evidence that the bank account information is critical for predicting default.

4.6 Conclusions

This chapter demonstrates that the accuracy of default prediction improves when a model based on bank account information is used in addition to the default prediction model based on traditional financial information. Improvement tends to increase when the company is small. If it is small, the quality of financial data is generally assumed to be low, but the bank account information model can complement this.

For small firms, the accuracy of the default estimation of the bank account model is superior to that of the financial model, supporting the possibility that banks can determine the credit risks of SMEs even if only the bank account information is used.

If the utilization of the bank account information model spreads, banks can reduce credit costs and review times and costs and lend to SMEs more efficiently. Bank account information cannot be manipulated by an information provider for the purpose of tax returns or loan applications, as is the case with financial information, so the bank receiving the account information can easily examine the data even if the target company is a new customer. Accordingly, concerns over the credibility of the information and the personnel costs to scrutinize it, which are intrinsic issues for financial scoring loans, are eliminated.

In addition, lending based on bank account information enables a bank to easily calculate the upper lending limit. By grasping the annual cash flow of the borrower's account, a bank can estimate the realistic amount a borrower can repay. Considering this estimate, the bank can then determine the loan amount. In contrast, the traditional financial scoring model is based on the financial statements of the previous fiscal year, so simulations of the possible lending amounts do not work well in some transactions. As such, this may lead to excessive lending.

One limitation of the bank account model is that the level of information depends on the depth of relations between banks and corporate customers. If a bank has a weak relationship with a firm, the bank account information may not grasp the whole picture of the firm's business activities. However, recently, "cloud accounting firms,"[11] which can be classified as fintech companies, are providing automatic accounting services to banks. Cloud accounting systems enable accounting firms to easily access bank account information from various institutions. Soon, banks with small shares of deposits will not be significantly disadvantaged if they have tie-ups with those accounting firms or corporate customers.

[11] Users provide the account information of all their creditor banks on the accounting software (applications) of the cloud firm, making a journal entry for each deposit and withdrawal to streamline their monthly accounting work and account settlement procedures. The users can then inquire about their financing directly to financial institutions during the accounting process. By collaborating with this accounting software, financial institutions can obtain the account information of other banks, subject to the prior consent of the user; that is, banks can potentially obtain information on all of the client's accounts.

The use of bank account information can be an effective tool for banks in analyzing the business and financial conditions of their customers and providing effective consulting services. In addition, it can identify commercial distribution and potential business opportunities for clients. The speed and accuracy of the data can also be useful for grasping the impact of macro shocks, such as currency appreciations or natural disasters.[12]

The empirical analysis in this chapter is targeted at SMEs in Japan, but the results may also be relevant for other countries, especially emerging countries in Asia. In Asia, the proportion of companies receiving bank loans is as small as 15.4% for small companies, but 79.4% have accounts in banks and use bank accounts for settlements, etc. (ADB 2015). If bank account information can be used systematically, we can expect the expansion of loans for SMEs.

The policy implications of this chapter are that financial institutions should enhance their credit risk assessment and improve service quality by leveraging bank account information. Financial institutions would be more efficient if they have a common database and share information rather than developing systems on their own. As a possible solution for other Asian economies, we provide the example of the RDB in Japan and show how to create a credit risk model based on financial and bank account information data. This could be important for policy makers in providing good guidance to financial institutions and supporting the development of the credit information system. If the use of bank account information prevails, it could help SMEs have easy access to finance and enhance growth and productivity.

References

Anzai, K. 2015. Issues in the Assessment of Small and Medium-sized Enterprises by Financial Institutions and Suggestions for a New Methodology (in Japanese). PhD dissertation. Sakushin Gakuin University.

Asian Development Bank (ADB). 2014. *Asia SME Finance Monitor 2013.* Manila.

———. 2015. *Asia SME Finance Monitor 2014.* Manila.

[12] The case of Kumamoto Bank, located in Kumamoto prefecture in Japan, is an example where bank account information has been used for disaster management. After the Kumamoto earthquake, Kumamoto Bank fully utilized bank account information to identify the areas and sectors most hit by the earthquake and took proactive remedy measures in collaboration with local governments.

Behr, P., A. Guttler, and D. Plattner. 2004. Credit Scoring and Relationship Lending: The Case of German SME, Version 16. March. Frankfurt: University of Frankfurt.

Financial Services Agency. 2003. Progress of Action Program for Strengthening Relationship-based Banking (as of the first half of FY2003) (in Japanese).

Grunert, J., L. Norden, and M. Weber. 2005. The Role of Non-financial Factors in Internal Credit Ratings. *The Journal of Banking and Finance.* 29(2): 509–531.

Hergen, F., and M. Wahrenburg. 2003. Evaluating Internal Credit Rating Systems Depending on Bank Size. Working Paper, Goethe University Finance & Accounting No. 115.

Hirata, H. 2005. Recent Development in Japan's Small and Medium-sized Enterprise Finance (in Japanese). *Keiei Shirin, Hosei Journal of Business.* 41(2): 31–51.

Small and Medium Enterprise Agency (SMEA). 2003. White Paper on Small and Medium Enterprise 2003.

———. 2015. White Paper on Small and Medium Enterprise 2015.

Yamori, N. 2003. Financial Services Desirable for Enterprises and Issues in SME Finance: Focusing on the Annual Survey of Corporate Behavior Regarding Corporate Finance in the Kansai Region (in Japanese). RIETI Discussion Paper Series No. 06-J-003.

Yanagisawa, K., H. Shimoda, E. Okdada, N. Simizu, and M. Noguchi. 2007. An Analysis on the Historical Change of Explanatory Power of Credit Risk Model based on the RDB Database (in Japanese). *Japanese Association of Financial Econometrics and Engineering, Proceedings of 2007 Summer Conference*: 249–263.

Yoshino, N., and F. Taghizadeh-Hesary. 2014. Analytical Framework on Credit Risks for Financing Small and Medium-sized Enterprises in Asia. *Asia-Pacific Development Journal.* 21(2): 1–22.

Yoshino, N., and H. Yamagami. 2017. *Monetary Economics: Practice and Theory* (in Japanese). Tokyo: Keio University Press.

Yoshino, N., F. Taghizadeh-Hesary, P. Charoensivakorn, and B. Niraula. 2016. Small and Medium-sized Enterprise Credit Risk Analysis Using Bank Lending Data: An Analysis of Thai SMEs. *Journal of Comparative Asian Development.* 15(3): 383–406.

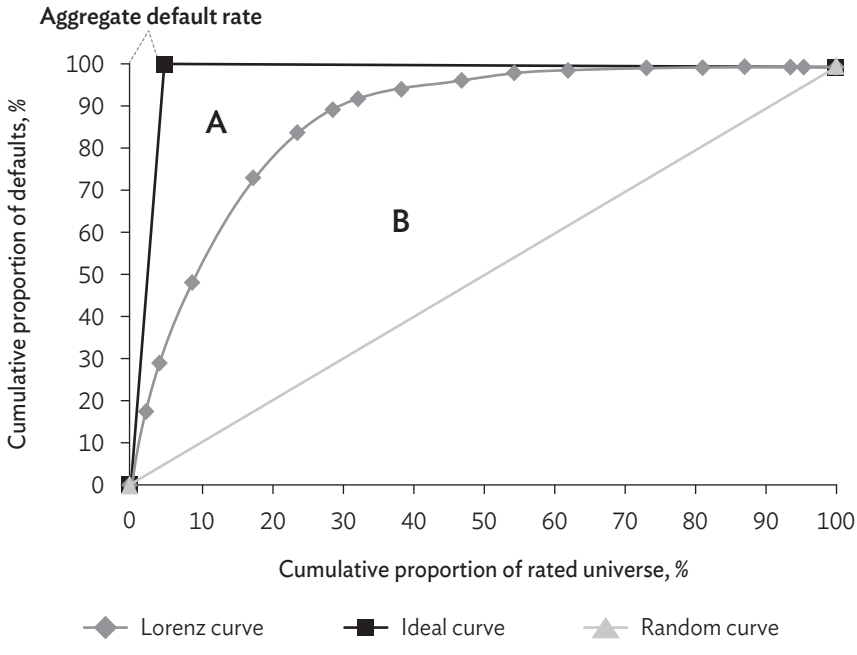
Appendix: Accuracy Ratio

The accuracy ratio (AR) is a summary of the quantitative measure of the discriminatory power in classification models, e.g., credit scoring models. The AR measure expresses the ratio of the area above and under the power curve (cumulative accuracy profile of the model under consideration versus the "perfectly" discriminating models).

An AR can take a value between 0 and 1. The closer AR is to 1 (100%), the larger the excess surface covered by the CAP curve, and the higher the discriminative power of the classification system.

The AR is sometimes also denoted as the Gini coefficient. The procedure for calculating the Gini coefficient is illustrated below. Area B is bounded by the random curve and the Lorenz curve, while area A is bounded by the Lorenz curve and the ideal curve. The Gini coefficient (AR) is defined as area B divided by the total of areas A plus B.

Figure A4.1: Sample Lorenz Curve



Source: S&P Global Fixed Income Research.

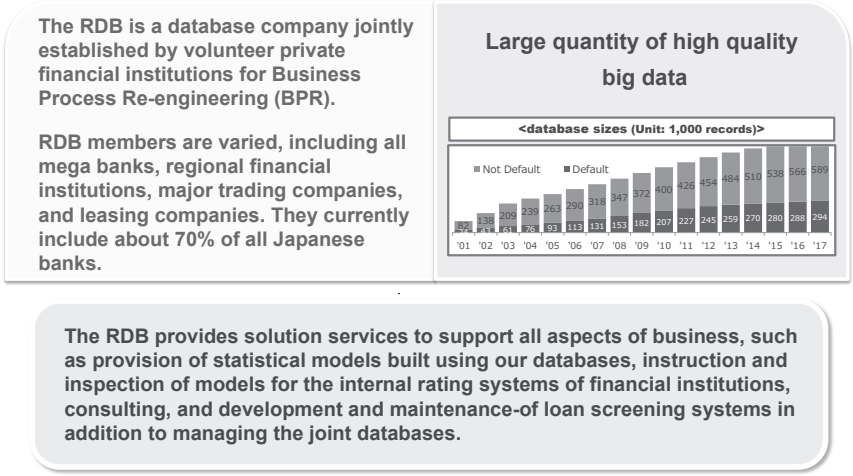
Role of the Credit Risk Database in Japan: Creation of New Economic Activity Indicators Through Dynamic Monitoring of Bank Accounts

YUTAKA OHKUBO
Risk Data Bank of Japan

The Risk Data Bank (RDB) was established by volunteer private financial institutions for business process re-engineering. The joint response to the Basel regulations is included in the scope of business.

Since its joint establishment by 21 private financial institutions, including all mega banks, the RDB has conducted business for 20 years as the first Japanese database consortium for credit risk management.

Figure 5.1: Risk Data Bank of Japan, Limited



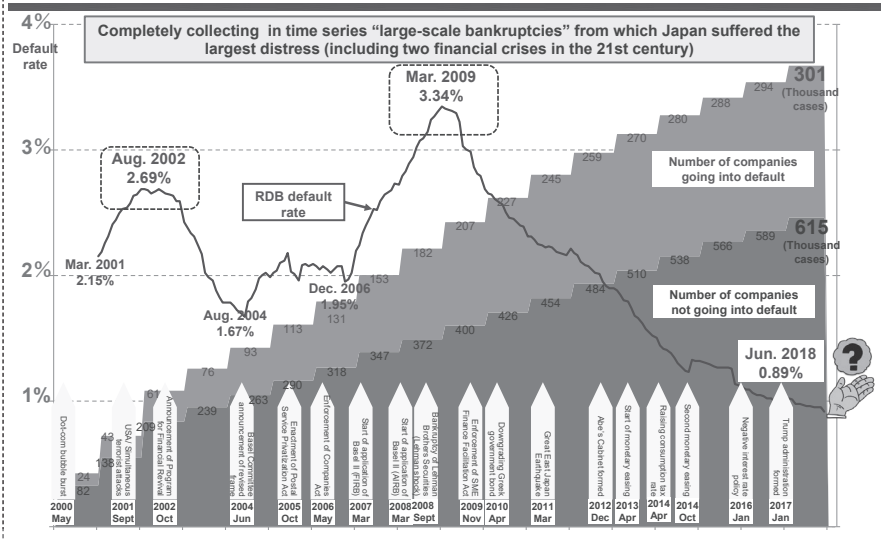
Source: Author.

RDB member financial institutions can access joint databases by providing the RDB with updated, detailed credit information. Each bank introduces a credit-rating model generated from RDB's databases for its credit decision-making process.

Seventy percent of Japanese banks nationwide are members of the RDB. These include all mega banks: Sumitomo Mitsui Banking Corporation, Mizuho Bank, MUFG Bank, and Japan Post Bank. Mega trading companies Mitsubishi Corporation and Sumitomo Corporation and government-affiliated financial institutions, such as the Development Bank of Japan, are also members.

RDB's many products are introduced in the backbone of decision-making to cope with credit risks. So, its members' discipline is extremely high, and this leads to continuous provision of high-quality data. The RDB is a very successful database consortium as it has autonomously expanded and improved operations.

Figure 5.2: RDB Corporate Default Rate



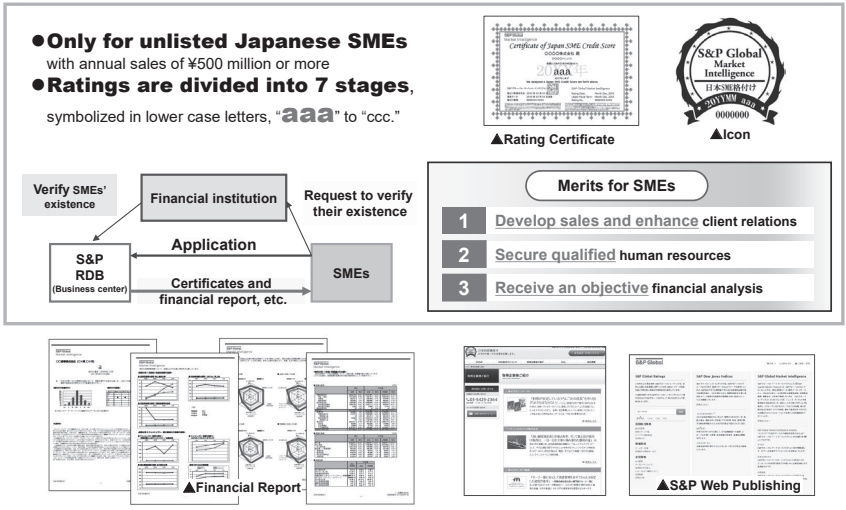
Source: Author.

As shown in Figure 5.2, the RDB succeeded in collecting the most comprehensive and the best data on credit risks at times when it could and had to collect them. These data cover large bankruptcies due to the bursting of the Japanese bubble economy, losses of about $1 trillion in 2002 alone, the terrorist attacks in the United States, the two global financial crises triggered first by the failure of Lehman Brothers and then the debt crisis of the Greek government, the Great East Japan Earthquake, and so on.

As the Japanese economy saw a surge in the number of bankruptcies, the RDB successfully collected data from all corners of the country on the demise of about 80% of over 300,000 failed businesses. In addition, it gathered from each one of them all financial statements for the terms leading up to their demise, and the data thus collected was just like electrocardiograms done.

The black line in Figure 5.2 shows three surges in the RDB corporate default rate. After the collapse of Lehman Brothers, the rate reached a peak at 3.34%. Currently, it is extremely low at 0.89%.

Figure 5.3: Japan SME Credit Score by S&P Global Market Intelligence



Source: Author.

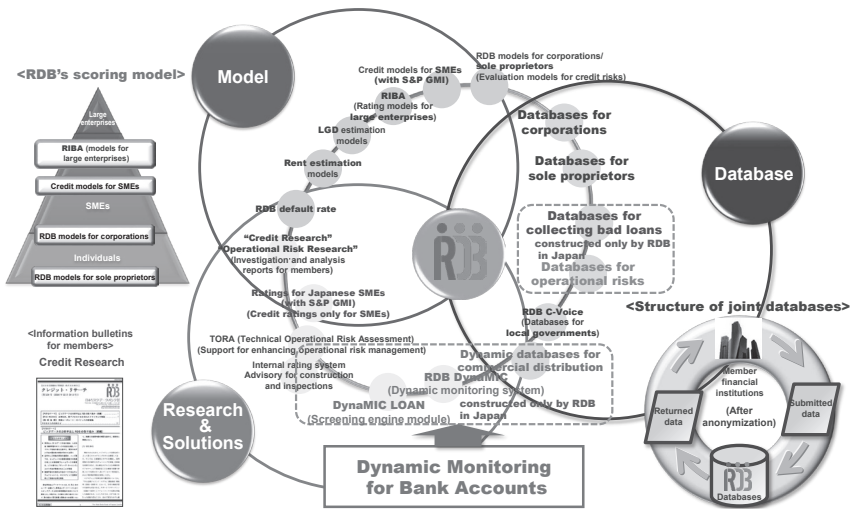
The RDB launched a rating service for unlisted small and medium-sized enterprises (SMEs) as a joint project with S&P. It rates SMEs in seven grades and gives "aaa (triple a)" to top-ranking SMEs.

It issues certificates of rating to SMEs so that SMEs can display such certificates on the wall of their reception rooms or in other places. The RDB also provides a financial analysis report in order to present a road map towards higher rating. It also provides rating icons so these can be put up on companies' corporate websites.

SMEs effectively use ratings for business development by emphasizing their creditworthiness to business partners. This service is also used effectively when SMEs look to recruit high-quality human resources. It allows SMEs to overcome the restrictions on information disclosure. So far, 680 SMEs have obtained a rating from this service.

Figure 5.4 gives an overview of RDB's business portfolio from three perspectives: models, databases, and research and solutions.

Figure 5.4: RDB's Business Portfolio



Source: Author.

Nearly 20 years have passed since the database was created. The RDB hopes that such database is useful and companies further push forward with joint database projects in their respective countries.

The RDB builds many kinds of mathematical and statistical models and customizes the models for each bank. Credit risk models are built according to the scale of business, for example, large corporations, middle-ranking companies, SMEs, and owner-managers. These models consist of sub-models by industry.

The RDB has been expanding the scope of its database—from corporations to owner-managers, from probability of default to loss given at default, and from credit risks to operational risks.

The RDB alone has been successful in building the only loss given at default and operational risks joint databases in Japan. The operational risks databases are often used to respond to regulations and to prevent operational risks that have not yet occurred by sharing accidents and cases from other banks.

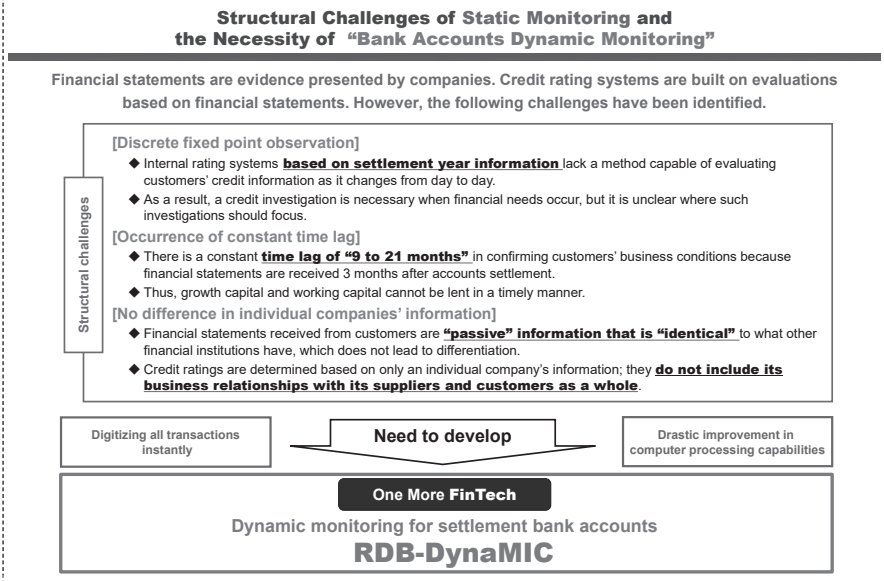
Creation of New Economic Activity Indicators through Dynamic Monitoring of Bank Accounts

Since 2011, as indicated by the red characters in Figure 5.5, the RDB has conducted research into the standardizing and structuring of the format of data on the settlement of bank accounts. It has developed mathematical models and systems as dynamic monitoring methods for credit risks. Along with the provision of systems, the RDB collects all settlement information from banks and includes this in RDB's joint database.

Recently, using dynamic settlement information in this huge database, the RDB conducted joint research with the Asian Development Bank Institute. (Please see Chapter 4 for details of the joint research.)

The RDB is the No. 1 company providing internal rating models for Japanese banks. But the challenge is that banks act together in the same direction at the same time.

Figure 5.5: Necessity of "Bank Accounts Dynamic Monitoring"



Source: Author.

The default characteristics of individual banks are different, but the final rating results are very similar. As a result, banks contact companies with good rating and frequently dump interest rates. On the other hand, banks refrain from lending money to companies with deteriorated ratings. There are many problems with static monitoring based on finance rating, which is past financial closing information.

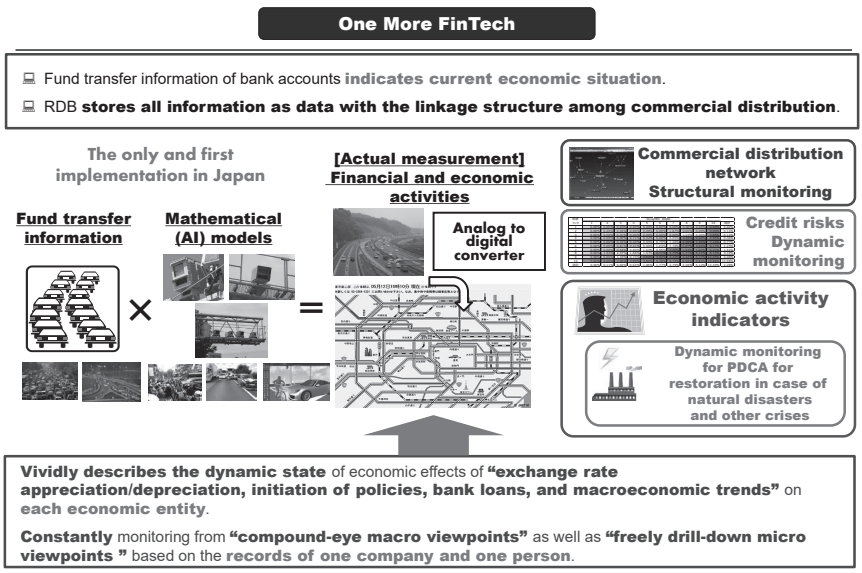
In rating systems based on financial year's information, it is impossible to continuously evaluate customers' credit situation as it changes from day to day, especially that of SMEs. It is necessary to conduct a credit investigation when financial needs occur, but where such investigations should focus on is unclear. As a result, decisions are made with a priority on collateral conservation.

In addition, there is a constant time lag of 9 to 21 months in confirming customers' business conditions because financial statements are received 3 months after accounts settlement.

Financial statements received from customers are passive information. They are identical to what other financial institutions have, which does not lead to differentiation. Moreover, credit ratings are determined based only on an individual company's information; this does not include its business relationships with its suppliers and customers.

Of course, financial statements are evidence presented by companies. Without a doubt, credit rating systems continue to be built on this evidence. But dependence on financial statements alone will not make it possible to develop and stabilize the financial system. A new method complementary to static monitoring should be developed. That is the dynamic monitoring for settlement bank accounts, and may be one more type of fintech.

Figure 5.6: Dynamic Monitoring of Bank Accounts



Source: Author.

In the end, companies and individuals complete economic activities by settling through money, and most activities are implemented through bank accounts.

Details of banking transaction information include a lot of the latest information as objective facts. Conducting scientific and automatic monitoring in the dynamic time series give a clear picture of the latest economic situation of companies and individuals and the current status of commercial distribution networks. RDB-DynaMIC stores all information as data with a linkage structure between commercial distributions, after mathematical data processing.

The important point of this innovation is to vividly describe the dynamic state of the national economy—such as effects of exchange rate fluctuations, initiation of policies, bank loans, and macroeconomic trends—and how this affects each economic entity.

This innovative technology realizes new monitoring from compound-eye macro viewpoints as well as freely drilled-down micro viewpoints. This is performed by fund linkage and time shift records and is measured based on the records of each company and each person. These records are real economic evidence that can always be automatically updated in real time.

This financial monitoring system is like monitoring cameras along road networks set up to gather information in real time on driving, traffic jam, and accidents. From the main roads, the cameras could zoom in each car when necessary.

Dynamic monitoring is complementary to static monitoring in the following three dimensions.

The first is dynamic credit risk profiling based on bank account trends. By using information on liquid deposit balance and trends in cash transactions, using mathematical models, changes on credit risk can be daily and constantly monitored. By setting triggers in advance, computers automatically generate credit news and automatically show on screen fund needs at all times.

The second is structural credit risk profiling. The loan application content can be verified, and fraud risks can be eliminated. Structural credit risk profiling can check if applicants exist and are engaged in the economic activities described in the financial statements or loan application. Chain bankruptcy and chain growth can also be viewed in full detail. Thus, computers can replace staff in many screening processes where workers are necessary. A financial system in which anybody can apply for loans anytime and anywhere is realizable. The national financial system can be developed incredibly and enormously.

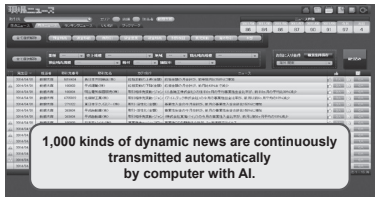
The third innovation is dynamic economic activity indicators.

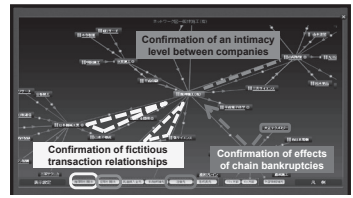
Figure 5.7: Dynamic Monitoring

Structuring many micro prudence into consistent macro prudence

<by company/person> ⇒ (by region)⇒ (by industry) ⇒ (by size) ⇒ <national economy>

- **Automatically continuously monitoring** what kind of issues the national/regional economy has at present, which business types and which size of companies are short of funds, and which age group and occupation have low income levels.
- **Automatically monitoring** which region/business type/size/occupation are largely affected by fluctuations in foreign exchange rates by visualizing clouds approaching, rain falling.
- **Making after-the-fact verifiable policies** by scientifically measuring the economic effect of policy implementation.
- To realize a better, healthy society, **finding out rationally and timely "vulnerable groups in society"** required for safety.
- Monetary and fiscal policies to inject necessary funds into necessary factors at **a pin point like "catheter operation."**





Source: Author.

Artificial Intelligence mathematics accumulates and analyzes data from various levels of micro prudence—such as the economic activities of individual persons and enterprises—through financial activity at the regional level, by industry, and by enterprise size. Finally, these reach the national level, building up to the highest level of macro prudence, in an integrated, consistent manner.

Artificial intelligence (AI) mathematics constantly and automatically search economic news and communicate them to policy makers and present possibilities in the news as hypothetical AI scripts.

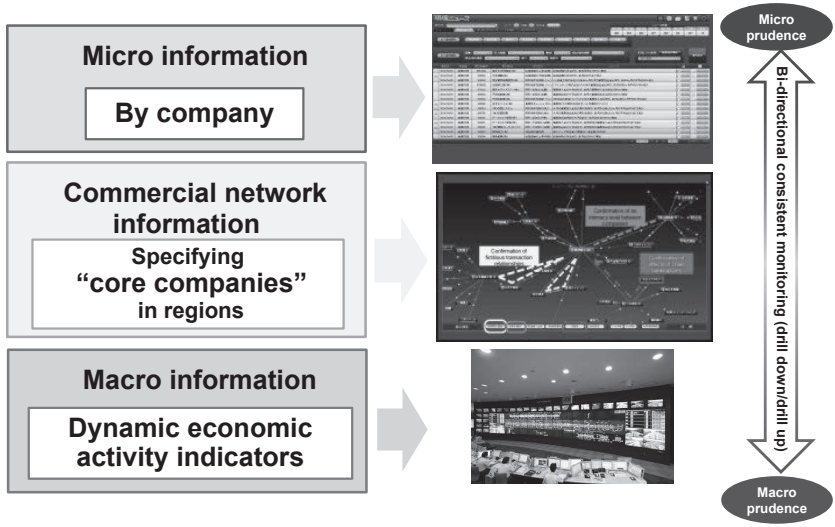
Current social and economic statistics have many problems, such as time lagging and incompleteness. Those problems can be significantly complemented by this innovation.

Timely monitoring can be conducted on the following issues.

What kind of specific problems does our economy have, and in which business category, corporate size, and regional area are fund flows getting weak? In which age group and in which job category are income levels getting low? Which region, business category, size and job category are affected by exchange rate fluctuations and changes in business conditions of core companies?

To create a sounder society, the RDB will be prepared to make a timely hypothesis on the socially vulnerable people who need safety nets immediately. It can increase and pinpoint public and financial spending, like a catheter operation, by investing the necessary funds and implementing the necessary policies for people in need. In addition, spillover effects caused by the implementation of all kinds of policies can be measured and policy planning can be innovated through plan-do-check-act (PDCA).

Figure 5.8: Development of SMEs through Dynamic Monitoring of Bank Accounts



Source: Author.

The dynamic monitoring of bank accounts is extremely effective in providing, in a timely and specific manner, support for the development of varied and diverse SMEs. It can also provide urgent assistance to them because both micro prudence and macro prudence can be achieved simultaneously.

As micro prudence, the amount of change in the monthly receipt or payment of business money and the monthly wages payment is constantly monitored. Companies whose business performance is declining due to fluctuations in the exchange rate and those riding on a wave of global inter-industry relations are automatically extracted. This extraction leads to timely growth funding and boost to the nation's growth potential.

RDB's database can analyze the economic structure from the perspective of funding relations using this microeconomic information. It scientifically identifies hub companies that generate the commercial distribution in a region. It also identifies companies that are high in the list of money remitted or received by enterprises or individuals in a region. The primary and secondary amount of commercial distribution by the hub companies are monitored. We can classify commercial structure into inbound, outbound, local autonomous, and so on. It allows quantitative evaluation of the effectiveness of policies that have been implemented.

Microeconomic information and information about commercial distribution are freely collected using various perspectives to establish dynamic economic indicators. Micro prudence and macro prudence combine to enable the development of SMEs.

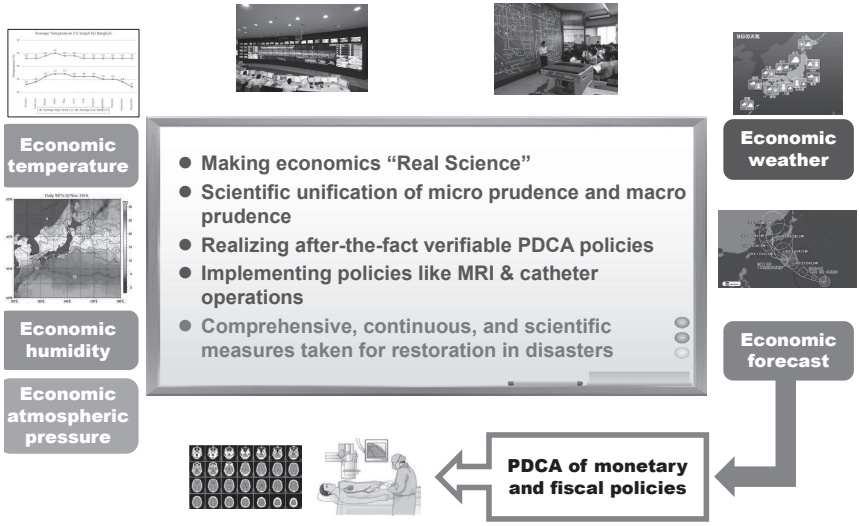
What are the fruits of new dynamic economic indicators based on the dynamic monitoring of bank accounts?

It is to make economics "a true science." What is the economy?

The economy is defined as the aggregate of all details of all fund movements.

All details of tens of trillions of bank transactions are collectively considered as the "economy," and this becomes the target of scientific research, just as the weather is the target of scientific research in meteorology.

Figure 5.9: Dynamic New Economic Indicators



MRI = magnetic resonance imaging, PDCA = plan-do-check-act.

Source: Author.

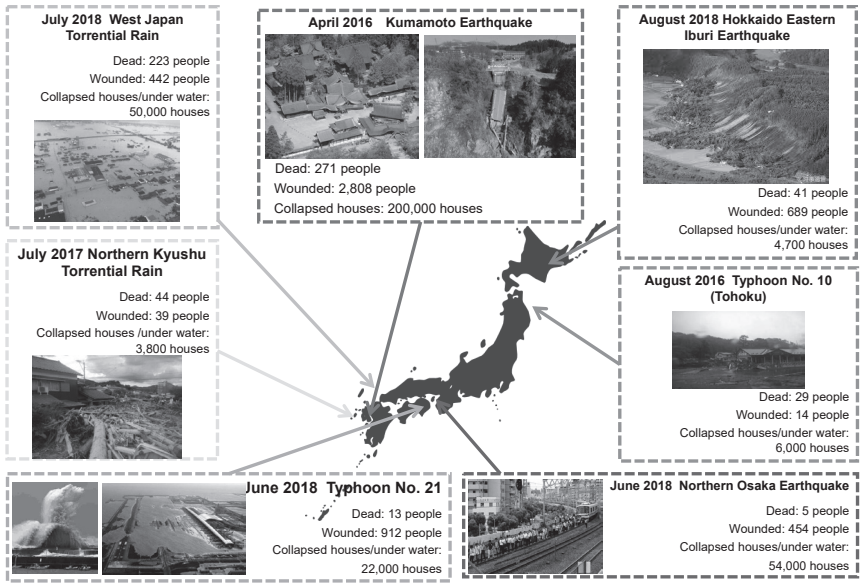
Highly recommended are the following:

(i) Develop indicators of "economic temperature," "economic humidity," and "economic pressure."
(ii) Develop the notion of "economic weather" by scientifically combining the indicators above.
(iii) Establish methods for "economic weather forecasts."
(iv) Imagine and create new monetary and fiscal policies which control the economy and guide it in a better direction.
(v) Realize a scientific combination of micro prudence and macro prudence as well as dynamic monitoring.
(vi) Realize PDCA policy that can be verified later.
(vii) Bring revolutionary innovation in analysis of inter-industry relations.
(viii) Invoke effective policy like magnetic resonance imaging and catheter surgery.

The above is not an empty dream.

Japan has started to use these scientific methods in reconstruction exhaustively and continuously when a massive disaster occurs.

Figure 5.10: Disasters in Japan (2016–2018)



MRI = magnetic resonance imaging, PDCA = plan-do-check-act.

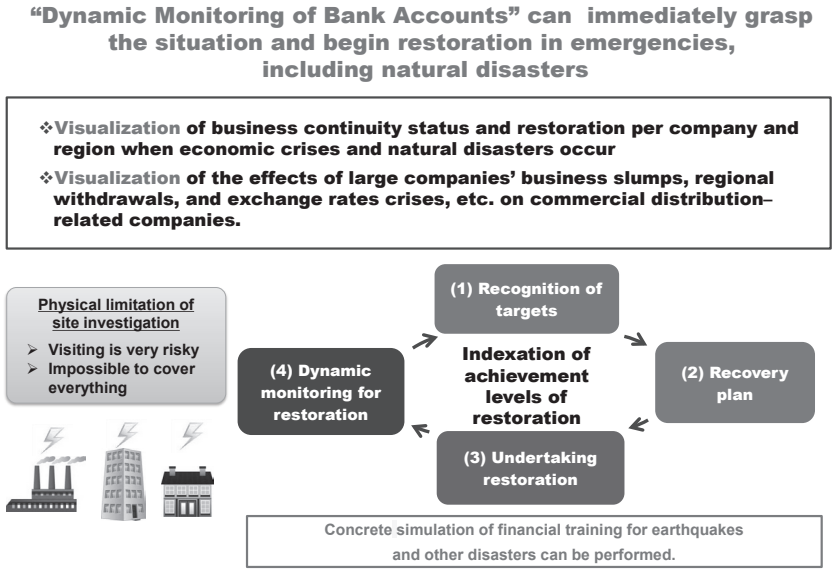
Source: Author.

Unfortunately, natural disasters occur continuously in Japan (Figure 5.10). The most recent examples in 2018 include an earthquake in Osaka in June, torrential rains in western Japan in July, an earthquake in Hokkaido, and a massive disaster caused by Typhoon No. 21 in August. Since the Kumamoto earthquake in April 2016, the RDB has supported reconstruction through the dynamic monitoring of bank accounts.

This is the summary of RDB's actions when the Kumamoto earthquake occurred (see website of the Bank of Japan, https://www.boj.or.jp/en/index.htm/).

After disaster from an earthquake, field surveys cannot be fully conducted due to continual aftershocks and absolute shortage of manpower. Dynamic monitoring of bank accounts is a method of monitoring all things immediately.

Figure 5.11: Emergency Monitoring and Reconstruction Plan



Source: Author.

Regarding changes in economic activities on a micro basis, such as cash transactions and wage payment, the RDB objectively and immediately understood the effects of the earthquakes on the economy and industrial network structure by making a dynamic comparison of their state before and after the earthquakes.

After recognizing damage to "hub companies" and "core commercial distribution" in terms of an objective numerical value, scientific preparation of the most effective solutions through "financial and public support" was realized as Recovery plan. These include emergency loans for working capital and medium and long-term loans for restoration.

The RDB conducts monthly monitoring to see if the restoration policies are producing expected results. This makes the PDCA workable.

As an example of RDB's specific response to the Kumamoto earthquake, Figure 5.12 (please refer to Panel A) expresses monthly dynamic indicator changes in the receipt of money in accounts for business-related funds by industry. This shows that due to

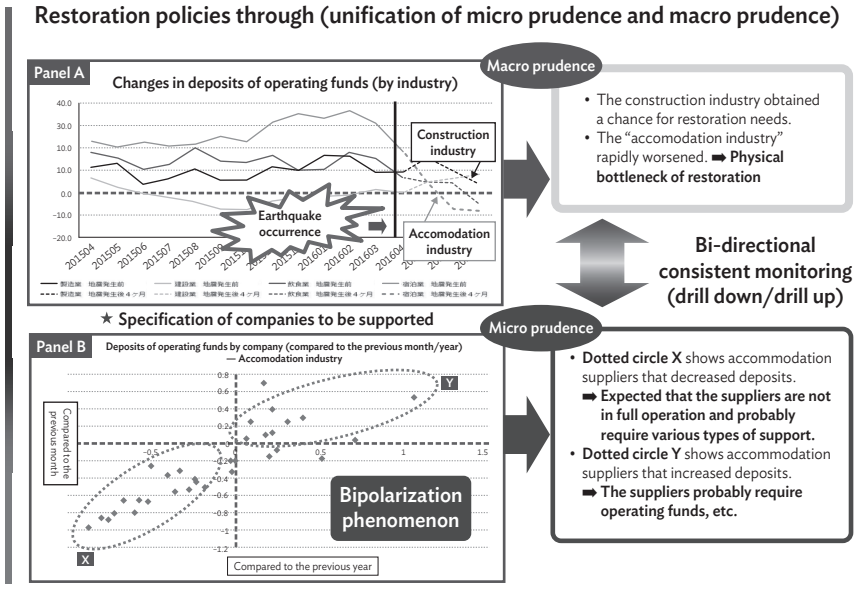
the occurrence of the earthquake, the construction industry gained opportunities to meet reconstruction demand. The need and degree of supplying working capital and personnel to constructors are expressed in numerical terms.

On the other hand, the figure indicates that the hotel industry deteriorated rapidly. After the massive earthquake, many hotels collapsed and sightseeing demand fell to zero. The degree of recovery of the hotel industry's supply capacity became a physical bottleneck for reconstruction. Many workers were required for reconstruction.

The dynamic monitoring of bank accounts excels in drilling down the monitoring of these economic indicators at the macro-prudence level to that of economic activities at the individual company level.

This is indicated in Figure 5.12, Panel B. The situation of the hotel industry deteriorated substantially, but there was a polarization of business performance with certain hotels doing well. The vertical y-axis indicates month-on-month changes and the horizontal x-axis year-on-year changes, and the point where the axes meet shows plus minus zero. The graph shows a remarkable case of polarization.

Figure 5.12: Restoration after the Kumamoto Earthquake

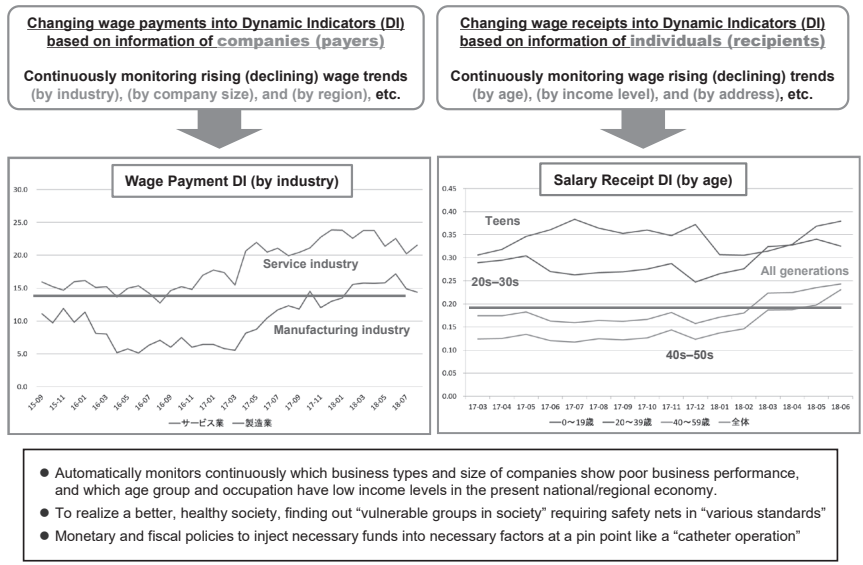


Source: Author.

This result means that people rushed to hotel operators who had escaped from destruction.

Long-term financing is required for the operators (surrounded by gray broken lines). Reconstruction policy makers can list specific targets.

Figure 5.13: Dynamic Economic Indicators (Individuals)



Source: Author.

These figures show examples of dynamic economic indicators for individuals.

Since the database is based on individual personal information, those indicators can be freely generated in regions, income levels, age groups, and so on.

The figure on the left-hand side expresses paid wages by industry in dynamic indicators (DI). Based on information from enterprises or payers of wages, how wages are paid is expressed in DI. Wages are constantly monitored using perspectives such as industries, business size, and regions as they rise and fall. Again, the monitoring of bank accounts can be drilled down to the individual company level using the point of view that interests one.

The figure on the right-hand side expresses the receipt of wages in DI.

It shows a dynamic economic indicator of wages based on information obtained from individuals, in other words, receivers of wages. Wages are constantly monitored using perspectives such as age groups, income levels, and places of residence as they rise and fall.

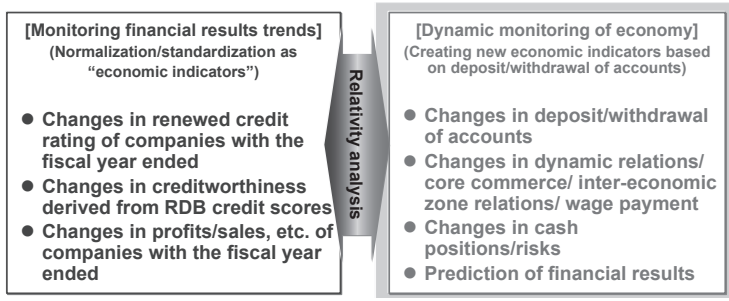
What kind of specific problems does Japan's economy have and in which age group and job category are income levels getting low? Which region, business category, size and job category are affected by exchange rate fluctuations and changes in business conditions of hub companies?

To create a sounder society, Japan should be prepared to make a timely hypothesis on the socially vulnerable people who need safety nets immediately.

The RDB can increase and precisely pinpoint public financial spending, like a catheter operation, by investing the necessary funds and implementing the necessary policies for the people concerned.

Finally, Figure 5.14 is a summary of RDB dynamic economic indicators.

Figure 5.14: Relativity Analysis (Mutual Complementation)



財務ランク	DynaMIC RANK										
	1	2	3	4	5	6	7	8	9	10	総計
1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	0.00%	0.20%	0.34%	0.00%	0.00%	0.00%	1.67%	0.00%	0.00%	0.00%	0.14%
3	0.00%	0.00%	0.31%	0.00%	0.00%	0.00%	0.00%	1.43%	0.00%	3.85%	0.14%
4	0.00%	0.00%	0.00%	0.71%	0.42%	0.00%	0.65%	2.38%	0.00%	4.65%	0.36%
5	0.00%	0.00%	0.34%	0.34%	0.00%	0.79%	1.46%	2.38%	1.96%	7.14%	0.77%
6	0.00%	0.00%	0.81%	0.41%	0.00%	1.03%	1.18%	1.07%	3.60%	9.17%	1.23%
7	0.00%	0.00%	0.53%	0.89%	1.63%	0.95%	2.26%	1.63%	1.07%	6.21%	1.51%
8	0.00%	1.53%	2.03%	1.68%	1.93%	2.71%	3.79%	1.71%	5.22%	8.14%	3.19%
9	0.00%	0.00%	1.18%	0.74%	3.02%	3.94%	3.24%	3.32%	5.77%	10.05%	4.46%
10	7.41%	0.00%	7.32%	3.95%	3.94%	5.38%	6.74%	8.90%	9.82%	18.86%	10.88%
総計	0.06%	0.11%	0.60%	0.64%	1.06%	1.77%	2.79%	3.30%	5.12%	12.40%	2.28%

Source: Author.

CHAPTER 6

Optimal Regulation of Peer-to-Peer Lending for SMEs

NAOKO NEMOTO
Asian Development Bank Institute

DAVID STOREY
University of Warwick

BIHONG HUANG
Asian Development Bank Institute

6.1 Global Trend of Peer-to-Peer Lending

In recent years, internet-enabled peer-to-peer (P2P) lending has emerged as an alternative to bank lending. P2P lending platforms provide an online marketplace that matches investors willing to lend with borrowers seeking loans, removing the need for banks to act as intermediaries. Borrowers may be individuals or businesses, depending on the platform. Likewise, lenders may be individuals or collectives.[1] In light of the much-discussed failure of banks to provide adequate loans to small and medium-sized enterprises (SMEs), this development offers a significant opportunity. The purpose of this chapter is to describe and evaluate the range of P2P lending systems on offer to SMEs in several countries, taking different regulatory regimes into consideration. It builds on the insightful work of Atsushi Samitsu, who contrasts the legal arrangements across Japan, the United Kingdom (UK), and the United States (US) (Samitsu 2017). We take this analysis further by identifying and assessing the main types of risk involved across four countries, analyzing the different regulatory responses, and weighing both of these against a set of universal principles of good regulatory practice.

Traditional banks are often reluctant to lend to smaller companies because higher default rates, a lack of data, and a smaller scale make lending to them less profitable. As a result, many SMEs are unable to obtain funding. With SMEs estimated to represent 55% of gross domestic product in Organisation for Economic Co-operation and Development economies and 60% of employment worldwide

[1] The term "peer to peer" is arguably best suited to small-scale loans from individual lenders to individual borrowers who may wish to seek funds for consumer purchases. It has also been used to refer to arrangements involving SMEs. We use the term to include this latter practice.

(Edinburgh Group), the economic benefits of improving their access to finance could be substantial. The benefits to SMEs may go beyond mere access to this mode of alternative funding—competition from P2P platforms may also prompt banks to recapture market share by extending more loans to SMEs and improving the services offered to them. As we will show, there have been many different attempts to construct appropriate regulation around this new phenomenon, and these sometimes have unintended consequences. Finding appropriate modes of regulation for this emerging industry remains experimental and contested.

P2P lending platforms attempt to solve the problems of lending to SMEs by utilizing automated processes to reduce costs and credit risk models that use nontraditional data. P2P lending and other forms of fintech financing have grown rapidly over the last few years but have developed at very different rates in different countries. For fintech lending, of which P2P lending is the largest component, the People's Republic of China (PRC) and the US are the world's biggest markets; in 2015, $100 billion of new fintech credit was issued in the PRC and $34 billion in the US.[2] These examples dwarf other markets, which are mostly still in a nascent stage: fintech credit volume was $1.1 billion in Asia and the Pacific (excluding the PRC), and less than $1 billion in the Eurozone (Bank for International Settlements 2017). Loans to individuals comprise a large part of P2P lending in the PRC and the US. P2P lending to business is still relatively small but has grown rapidly since 2013. The amounts of P2P lending to business in 2016 are shown in Table 6.1.

Table 6.1: Peer-to-Peer Lending to Business, 2016

	Volume of New Credit ($ billion)
People's Republic of China[a]	61.5
United States[b]	1.5
United Kingdom[c]	1.8
Europe excluding the United Kingdom	0.4
Japan[d]	1.2

Sources:
[a] Home of Online Lending. https://shuju.wdzj.com/industry-list.html (accessed 20 January 2019).
[b] Cambridge Center for Alternative Finance (CCAF). 2017. *The Americas: Alternative Finance Industry Report: Hitting Stride*. Cambridge; Chicago: Cambridge Judge Business School, CCAF; University of Chicago, Polsky Center for Entrepreneurship and Innovation.
[c] CCAF. 2017. *Entrenching Innovation: The Fourth UK Alternative Finance Industry Report*. Cambridge: CCAF.
[d] The Social Lending Industry Report 2017.

[2] These figures include loans to individuals and to businesses.

P2P lending carries inherent risks. Investors risk losing invested funds, and SMEs that rely on P2P services for funding face the possibility of capital drying up or becoming more expensive if the investor pool shrinks. The P2P business model also involves some stability concerns. Since P2P platforms receive revenue in proportion to the loan volume originated, they face financial incentives to maximize loan origination, even at the expense of credit standards. They also rate borrowers' credit themselves, despite not being exposed to the direct financial consequences of defaults. Another weakness of these platforms is their source of funding, which relies on investors retaining confidence in the platform to maintain lending levels. Since investors cannot rely on deposit insurance as they can with their bank deposits in many countries, P2P platforms that allow early withdrawal of funds are vulnerable to mass withdrawals if investors lose confidence. It remains unclear whether investors will be protected in the event of a platform's failure—a poorly managed, high-profile failure would not only cause losses to investors but also erode the trust needed for investors to keep on lending. Lending is also likely to be pro-cyclical, with unprofitable businesses sustained by cheap loans in some periods and priced out by very high interest rates when credit becomes expensive.

The challenge for regulators is to protect against systemic risks and maintain a fair, safe, and competitive market. At the same time, there is a need to encourage the growth of lending to realize its potential to transform small business funding and enhance economic growth. When considering the optimal nature and scale of regulation of this market, it is useful to state a set of guiding principles. Based on the past successes and failures of financial markets, we suggest a universal measuring stick against which to evaluate any system that can be constructed. The resulting template is shown in Figure 6.1.

To help meet these ideal conditions, it is critical to design appropriate regulatory instruments. To this end, it is useful to consider the range of regulatory regimes currently in force. In this chapter, we review and compare regulatory regimes in the US, the UK, the PRC, and Japan. Table 6.2 shows a schematic outline of the main comparator variables across these territories.

Using these criteria, we can describe and assess P2P lending practices and their regulation across four advanced countries that represent the largest P2P markets in the world: the US, the UK, the PRC, and Japan.

Figure 6.1: Principles Against Which to Evaluate Peer-to-Peer Lending Regimes

1. Peer-to-peer (P2P) lending should provide a safe and effective investment channel for a broad segment of society.
2. P2P lending should allow borrowers to access affordable and reliable capital on fair terms.
3. Lending should differentiate among borrowers based on risk of default.
4. Platforms should provide investors with an accurate understanding of credit risks, and investors should hold at least some of the risk to prevent moral hazard.
5. Unviable lending platforms should be able to exit the market without causing losses to investors or funding shortfalls for borrowers.
6. Lending should be robust enough during downturns in the economic cycle to prevent sudden stops in lending, excessive default rates, and problematic failures of lending platforms.
7. A competitive market between P2P platforms should be maintained to promote consumer choice; prevent rent seeking, monopolistic, or oligopolistic practices; and avoid the systemic risk of overreliance on one or a small number of platforms.
8. The sector should be socially useful and serve the real economy.

Source: Asian Development Bank Institute.

Table 6.2: Comparative Practices and Regulatory Regimes of Peer-to-Peer Lending

Comparative Criteria	United States	United Kingdom	People's Republic of China	Japan
General characteristics of the sector	Mainly geared to small individual loans Concentrated market, two main platforms	A number of mature players dominating the market A variety of platforms servicing different sections of the market	Very rapid growth in peer-to-peer lending A broad segment of society has access to a high-yield investment option. Fragmented market, many platforms	Mainly geared to small business needs Developed based on the needs of new investment tools
Nature of regulation	Extensive and stringent	Adaptive	Loose until recently, now tightening	Moderate
Regulatory bodies	The Securities and Exchange Commission governs investing; the Consumer Financial Protection Bureau and Federal Trade Commission oversee borrowing.	Financial Conduct Authority	China Banking Regulatory Commission	Financial Services Agency
Modes of regulation	Requirement to hold investors' money in bank accounts	Consultative approach	Trend toward involving local authorities and enabling self-regulation Requirement to hold investors' money in bank accounts	Three categories of regulation: equity, lending, and funds For equity, the rule of securities offerings is applied, and financiers must acquire a brokerage license.
Advantages of current regulation	Strong protection of lenders and borrowers Transparent data disclosure	Responsive to emerging risks and accommodating to market participants	New forms of regulation have encouraged growth in the sector.	Flexible, tailored regulation to meet different needs
Issues arising from current regulation	Stringent registration process, separate registrations needed by state	Ambiguous guidance for provision funds	Problematic, fraudulent behavior, calls for more regulation	Tension between the regulatory requirements of transparency versus anonymity

Sources: Bank of England, Japan Financial Services Agency, People's Bank of China, Federal Reserve Board (United States).

6.2 Peer-to-Peer Lending in the United States

The regulation of P2P lending in the US is fragmented. The Securities and Exchange Commission (SEC) is responsible for the investing side of these platforms, while the Consumer Financial Protection Bureau and the Federal Trade Commission regulate the borrowing side. The SEC forbids P2P platforms from crediting the borrower's loan directly to the lender. As a result, P2P lending platforms in the US do not function as true matching platforms. Instead, the lending platform asks a bank to originate a loan from the platform to the borrower. The platform then issues a debt security to the lender, who becomes a creditor of the platform. There are significant regulatory hurdles for new entrants. As well as needing to obtain licenses from state governments, a process described by industry insiders as "costly and laborious" (Government Accountability Office 2011), platforms are not allowed to accept accredited investors until they register with the SEC. This requires a substantial amount of work by the platform, which faces strict reporting requirements once registered. One survey of US lending platforms found that 37% of investors believed regulation to be excessive, while only 6% wanted more regulation (CCAF 2017c). Despite the volume of regulation, doubts exist as to its efficacy. For investors, being creditors of the lending platform rather than borrowers exposes them to the risk that the platform will be unable to pay them if it encounters financial difficulties. However, this arrangement also has its advantages. Since the lending platform has legal status as the lender, it is responsible for adhering to laws that stipulate clear and fair disclosure of the loan terms to borrowers, providing explanations to those who are declined credit, and preventing unfair debt collection practices. This is preferable because the platform is better placed than individuals to ensure compliance with these regulations, and it makes it easier to enforce this legislation (Lo 2016).

The conservative approach to regulation in the US has given rise to a well-functioning sector that abides by most of the principles cited above. The limitations of the US approach chiefly relate to the issue of maintaining a competitive market. The market is dominated by two of the largest platforms, Prosper and the Lending Club, and the entry of new firms is impeded by the burdensome registration process at both the federal and state levels. In addition, incumbents and newcomers alike are discouraged from trying innovative business models by the regulatory compliance work involved. It is worth noting that in the US only a small percentage of P2P lending goes to businesses; the largest part goes to individual consumers seeking small loans. Meaningful competition that can offer more compelling solutions for business financing could help to remedy this. The regulation of P2P lending in the US arose from existing financial regulation that was adapted to fit this new industry.

Introducing new regulation specifically designed for this new business model could provide an environment more supportive of growth, competition, and innovation. In summary, the relative lack of SME funding stemming from P2P in the US may be a consequence of the mode of regulation to date in this country.

6.3 Peer-to-Peer Lending in the United Kingdom

In the UK, P2P platforms are assessed individually by the Financial Conduct Authority (FCA) and must obtain authorization to operate. The FCA emphasizes engagement with P2P companies. It provides feedback to companies on the regulatory implications of their plans and runs a regulatory sandbox to allow selected firms to test new models on the market. This dialogue-based approach extends to the FCA's development of new regulation. Feedback is sought from the industry regarding the successes and limitations of the current framework and the risks facing the industry. The FCA underwent a process of consultation regarding the implementation of its 2014 rules on P2P lending and published its response in a report in December 2016 (Financial Conduct Authority 2016). The report revealed the FCA's concern that relatively lighter regulation for P2P lenders and the increasing complexity of P2P lenders and the increasing complexity of P2P platforms' business models could result in regulatory arbitrage.[3] The activities attracting the attention of the FCA include the pooling of credit risk, which enables P2P platforms to act as asset managers; and maturity mismatch products, which allow investors to withdraw money before the end of their loan period and bring P2P platform activities closer to those of banks.

Although P2P platforms may benefit from some degree of regulatory arbitrage, it is not clear whether this light-touch approach would harm investors or borrowers. As noted by respondents to the FCA's call for feedback, P2P platforms are not leveraged or systemically important to the economy. Hence, light regulation of this sector may be justified. The FCA has responded that it will continue to monitor the situation and will act to prevent arbitrage if consumer welfare appears to be threatened. The FCA has also made known its dissatisfaction with the communication of risks to investors and may act further to set stricter requirements on this front.

[3] This term refers to the potential for P2P firms to carry out the same activities as traditional financial institutions while having an advantage due to a smaller regulatory burden.

Future regulation may also focus on "wind-down" plans, as the FCA believes that current plans may be insufficient if a platform were to fail. Perhaps a more significant issue is the fact that provision funds (where platforms cover the losses of investors) have become widespread in the UK P2P lending industry. One leading platform, RateSetter, claims that "The Provision Fund has a 100% track record: to date, every investor has received the returns they expected" (RateSetter 2017). While this has protected investors so far, guarantees of this kind provide investors with no incentive to reduce their risk and could offer them a sense of security that may turn out to be false if default rates exceed the amount that can be covered by the provision fund. On the other hand, these funds give P2P lenders some "skin in the game" by offering platforms an incentive to maintain underwriting standards that is not provided by the basic P2P business model of charging a commission on loan origination. This benefit should be weighed against the risks when designing regulation to tackle this practice.

The regulatory framework in the UK accords with most of the principles set out in Figure 6.1. This regulatory regime appears to be proportionate and appropriate to the circumstances, and may offer an effective model to follow. While the rate of industry growth means that risks and problems often emerge faster than new regulation can be introduced, the FCA's actions to date suggest that it has a sound understanding of the issues and has been responsive to the evolving dynamics in the industry. Investor protection in particular has received strong support; yet, regulation has been light enough to allow the market to develop largely unimpeded. However, the arguably lax approach to provision funds is potentially problematic and deserves more serious investigation to determine the most suitable regulatory response.[4] The P2P lending industry in the UK has been relatively successful in serving SMEs, with a high proportion of P2P loans going to businesses and several platforms specializing exclusively in business lending.

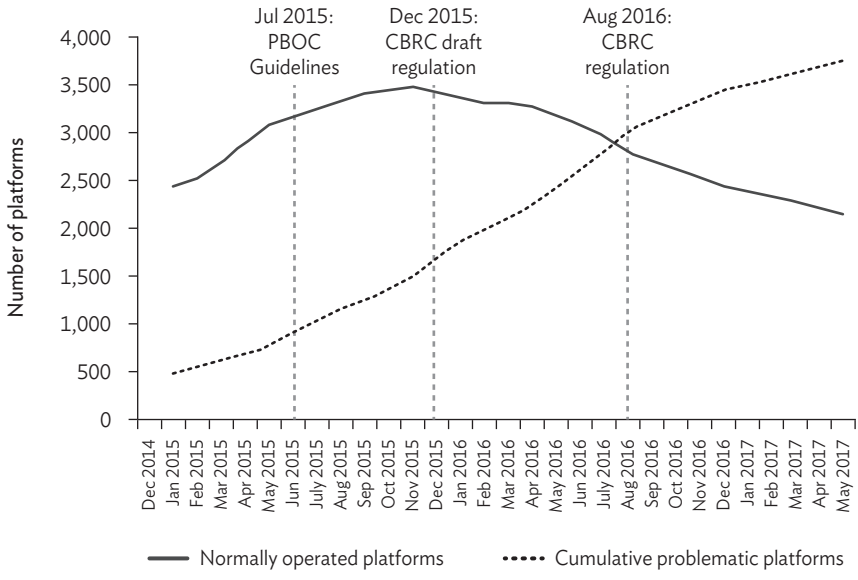
[4] Provision funds are insurance funds operated by the platform to indemnify investors so that they can expect a return on their investment even if borrowers default.

6.4 Peer-to-Peer Lending in the People's Republic of China

The P2P lending industry has grown faster in the PRC than in any other country. The sector remained largely unregulated for most of its history, enabling a proliferation of platforms with a variety of business models and varying degrees of viability. It is widely thought that the Government of the PRC has purposefully refrained from involvement in this sector to allow it to grow quickly and thus provide ready access to credit to underserved parts of the economy. As SMEs often find it difficult to secure loans from the state-owned banks that predominate in the PRC, the need for P2P lending is greater here than in most other countries. However, concerns over mismanagement and bad practices in the sector have grown steadily. Platform-side risks are seen as presenting the biggest set of problems (Yin 2017). A 2016 report described more than one-third of the PRC's P2P lending platforms as "problematic" (Leng 2016), referencing fraudulent behavior in a large proportion of cases (Yiqing 2016). Since 2015, regulation has become increasingly strict, beginning with the People's Bank of China issuing its Guidelines for Promoting the Healthy Development of Internet Finance. These guidelines did not introduce any official legislation but laid the framework for future regulation and provided guidance for the sector's activities. Responsibility for oversight was handed to the China Banking Regulatory Commission (CBRC), which has now merged with the PRC's insurance regulator to become the China Banking and Insurance Regulatory Commission. The guidelines communicated an intent to stop the widespread practice of guaranteeing returns to lenders. In late 2015, the CBRC published its draft regulations, granting regulatory responsibilities to local authorities and encouraging "self-regulation" by industry associations (Xie Ping and Haier). In August 2016, the CBRC released the first set of comprehensive rules called Interim Measures on Administration of Business Activities of Online Lending Information Intermediaries. These rules codified the prohibition of guaranteed returns, set borrowing caps of CNY1 million for individuals and CNY5 million for companies, banned P2P lenders from issuing securities to lenders, and mandated that lenders' funds should be held in custodian bank accounts (Wildau 2016; Yiqing 2016). In December 2017, the Implementation Plan for the Cleanup of Online Microloan Lenders set a specific timeline for the required actions, mandating provincial government agencies to complete the evaluation and registration of qualified P2P platforms in April 2018 (and no later than June 2018), and to formulate regulatory policies based on regional conditions.

Guarantees to lenders have allowed the PRC's P2P lenders to attract large numbers of investors by offering fixed returns. These guarantees have drawn special attention from regulators because they introduce serious stability risks. Under this scheme, payouts to investors are often not paid for by the underlying loans but rather through the funds provided by new investors. This Ponzi-like structure risks collapse if the number of new investors declines, and it incentivizes mass lending irrespective of the credit risk. The strict new rules pose an existential threat to the many platforms that have been operating under this model (the number of platforms has decreased by one-third since its peak in 2015) (Economist 2017). Yet, the rules have been welcomed by many in the industry, who see a reduction in the number of platforms as a positive step toward a more profitable sector. The PRC's lending platforms, in contrast to those in the US, tend to say that existing regulation is insufficient. In a survey of the PRC's P2P business lending platforms in March 2016, 68% called for increased regulation (CCAF 2016). As in the UK, tax incentives for lenders are often available, depending on local regulation.

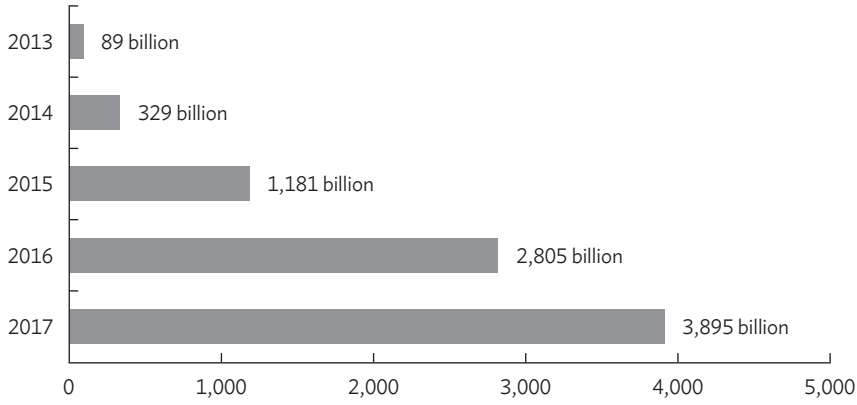
Figure 6.2: Platform Numbers and Regulatory Landmarks in the People's Republic of China



CBRC = China Banking Regulatory Commission, PBOC = People's Bank of China.

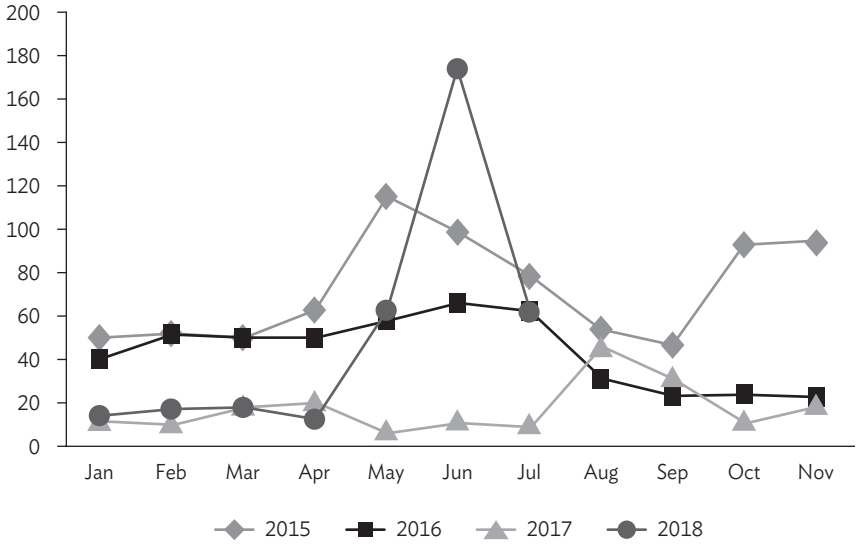
Source: Home of Online Lending. https://shuju.wdzj.com/industry-list.html (accessed 20 January 2019).

Figure 6.3: Volume of Peer-to-Peer Lending in the People's Republic of China, 2013–2017, New Lending Amounts (CNY)



Source: Home of Online Lending. https://shuju.wdzj.com/industry-list.html (accessed 20 January 2019).

Figure 6.4: Number of Defaulted Platforms by Month



Source: Home of Online Lending. https://shuju.wdzj.com/industry-list.html (accessed 20 January 2019).

The actions taken by regulators in the PRC have had a positive effect on the industry. Stricter regulation has successfully forced the closure of risky and fraudulent platforms. Figure 6.2 shows the consolidation the industry has undergone since the People's Bank of China announced the guidelines. Although the cumulative number of problematic platforms continues to rise, this figure includes firms that have exited the market—the industry will become increasingly safer as badly run firms exit the market. Systemic risks are greater in the PRC because the broad base of investors means that losses have a larger impact on society. The requirement to hold investors' money in bank accounts fundamentally changes P2P platforms' role from that of a financial intermediary to an information intermediary, as is the case in the US. This is a positive step toward providing investors with more financial security and preventing further cases of misappropriation of funds, which have caused significant losses for the PRC's P2P investors. The ban on guaranteed returns was a necessary step to curtail a problematic practice. Despite a troubled recent history of widespread malpractice, P2P lending in the PRC has gone further than in any other country in fulfilling the promise of providing a broad segment of society with access to high-yield investment options and filling the gap in SME funding. Its future success will hinge on maintaining this wide appeal to both investors and borrowers while continuing to mitigate systemic risks.

6.5 Peer-to-Peer Lending in Japan

In Japan, the Financial Service Agency (FSA) is the single authority charged with the regulation of P2P lending. The Financial Instruments and Exchange Law was amended in May 2015 to regulate crowdfunding. Although the total amount of finance remains about 2% of that in the PRC, the market is expanding rapidly. Lending reached CNY131,600 million in fiscal year 2017, 2.5 times the level in 2016. Most of the finance is used for loans to SMEs in various industries, including manufacturing and services, with the real estate sector ranked at the top. Local "hometown funds" have been created in many regions, attracting investors looking to support local specialties and revitalize their local economy.

Under the revised Financial Instruments and Exchange Law, crowdfunding is categorized into three groups: contribution, purchase of goods, and money investment. Within money investment, there are three subgroups: equity, lending, and funds. For equity investments, securities offering laws are applied, and platforms must obtain a Financial Instruments Business Operator Subsection 1 license (commonly used by brokerage firms). For lending and funds, operators must obtain

a Financial Instruments Business Operator Subsection 2 license. The requirement for Subsection 2 operators is less strict than that for Subsection 1 if the investment amount is small (less than ¥5 million) and securities offerings are listed on a website. This results in a relatively lenient approach toward P2P lending and is intended to promote its development. From the standpoint of protecting investors, the platforms are supposed to do the following:

(i) remain financially sound and have a minimum capital of ¥5 million;
(ii) maintain adequate operations and staff to meet the compliance guidelines;
(iii) conduct proper due diligence and monitoring of borrowers regarding financial conditions, use of proceeds, and business plans; and
(iv) preserve transparency regarding risks, fees, and other contract information.

The law prohibits platforms from providing guarantees to investors, and the FSA conducts inspections and monitors compliance with this law. Under these constraints, high operating and compliance costs make it challenging for the operator to obtain good returns.

With respect to lending, platforms must also secure money lenders' licenses under the Money Lending Business Law. This can lead to conflicts of interest between investors and borrowers. Under the Money Lending Business Law, platforms must maintain borrowers' anonymity, while the Financial Instruments and Exchange Law requires disclosure to protect investors. Information disclosed to investors includes how the borrower plans to use the funds, whether there is collateral for the loan, and an anonymized description of and comments about the borrower. One case illustrating this tension between the twin objectives of disclosure and anonymity is the fraudulent behavior of Minnano Credit. This company collected ¥4,500 million from investors, claiming that it would invest the proceeds in a spread of promising SMEs. However, in practice the proceeds were extended to a single entity that was affiliated with Minnano Credit itself. The company had hidden this fact from investors by exploiting loopholes in the disclosure requirements. Minnano Credit was subject to administrative sanctions, including a 1-month suspension of business activities. While there have not been many cases of scandal or misconduct in the P2P industry in Japan, this case presents a palpable example of the conflicts arising from the competing principles of disclosure and anonymity. The FSA is now considering revising the current legal framework and improving disclosure for investors.

In Japan, one constraint may be that the pressure for increased regulation may stifle the entry of new firms. New P2P platforms in Japan must obtain separate licenses for money lending and for handling financial instruments before they can begin activities. This is a major challenge because it is difficult to obtain start-up funding without first demonstrating a strong growth trajectory, which is only possible after obtaining the relevant licenses. A solution could be a regulatory sandbox, as implemented by the FCA in the UK, permitting new companies to operate under a provisional license until they graduate to a full license. The advantages of this are that it reduces entry barriers and allows the regulatory authority to see the business in practice, giving it a more accurate picture of the business before deciding to award a full license. Such a scheme would promote innovation by reducing the current pressure on new entrants to present more conservative plans to the regulator to avoid being turned down for a license before they can begin operating.

6.6 Comparisons Across Countries

Table 6.3 shows the remarkable divergence across these regulatory regimes. The regulatory bodies in these four countries have, purposely or inadvertently, shaped the profiles of their respective P2P industries. The UK and Japan have established regulatory sandboxes to allow new entrants to experiment without being overburdened with legal constraints in the early stage of their growth. Licenses are required in all four countries, but the ease of obtaining a license varies. The loan originator varies across these countries, depending on prevailing regulations. Since P2P platforms in the US and the PRC are restricted to the role of information intermediary, the platforms in these countries must rely on banks to originate the loans. In contrast, in the UK and Japan, platforms can issue their own loans.

Finally, the table shows that the safeguarding of investors through provision funds is common in the UK, less common in Japan and the US, and now prohibited in the PRC, although formerly widely used.

Table 6.3: Peer-to-Peer Regulatory Comparisons

Regulatory Feature	United States	United Kingdom	People's Republic of China	Japan
Regulatory sandbox available	No	Yes	No	Yes
Operational licenses required	SEC license and licenses from state governments; platforms operating without an SEC license can seek investments from accredited investors.	FCA license required but provisional licenses are common	Internet content provider license	FSA license
Role of the P2P platform	Facilitator of bank loans to borrowers; the platform purchases the loan using funds from investors.	Facilitator of loans between investors and borrowers	Facilitator of bank loans to borrowers	Direct lender and aggregator of investment funds
Originator of the loan	Bank	P2P platform	Bank	P2P platform
Provision funds	Permitted, but not a widespread practice	Permitted except for individual savings account (tax-free) investments	Not legally permitted but occur in practice	Not used

FCA = Financial Conduct Authority, FSA = Financial Services Authority, P2P = peer-to-peer, SEC = Securities and Exchange Commission.

Source: Authors.

6.7 Conclusions

Globally, the regulation of P2P lending has evolved significantly in recent years, with mostly beneficial effects on the industry. Regulatory responses have varied greatly among countries, and the characteristics of the markets that have emerged vary as a result. However, despite these regulatory efforts, some issues remain. There are problematic incentives for platforms that rate credit and originate loans without holding the risk of these loans. In addition, when platforms guarantee investor returns,

investors have no incentive to distinguish among risk categories. In several countries, notably the PRC, P2P platforms have engaged in fraudulent behavior and Ponzi-like schemes. On the other hand, stringent regulation in the US has excessively impeded new entrants from providing competition to established platforms. Regulators should be mindful of these risks and others, while also seeking to capitalize on the benefits that the sector offers for providing new funding opportunities to SMEs. The principles outlined in Figure 6.1 offer a general guide for assessing potential legislation; although the primacy of different issues varies across countries, regulators could use these principles as a starting point when engaging in constructive dialogue with market participants.

References

Bank for International Settlements. 2017. FinTech Credit: Market Structure, Business Models and Financial Stability Implications. *Report Prepared by a Working Group Established by the Committee on the Global Financial System*. Basel: Committee on the Global Financial System.

Cambridge Centre for Alternative Finance (CCAF). 2016. Harnessing Potential: The Asia-Pacific Alternative Finance Benchmarking Report. *Cambridge Centre for Alternative Finance at Cambridge Judge Business School*. Cambridge: CCAF. https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/harnessing-potential.pdf (accessed 20 January 2019).

———. 2017a. *Entrenching Innovation: The Fourth UK Alternative Finance Industry Report*. Cambridge: CCAF.

———. 2017b. *Expanding Horizons: The Third European Alternative Finance Industry Report*. Cambridge: CCAF.

———. 2017c. *The Americas: Alternative Finance Industry Report: Hitting Stride.* Chicago: Cambridge Judge Business School, CCA; University of Chicago, Polsky Center for Entrepreneurship and Innovation.

The Economist. 2017. In Fintech China Shows the Way. February. http://www.economist.com/news/finance-and-economics/21717393-advanced-technology-backward-banks-and-soaring-wealth-make-china-leader (accessed 10 September 2018).

Edinburgh Group. Growing the Global Economy Through SMEs. http://www.edinburgh-group.org/media/2776/edinburgh_group_research_-_growing_the_global_economy_through_smes.pdf (accessed 20 January 2019).

Financial Conduct Authority. 2016. *Interim Feedback to the Call for Input to the Post-Implementation Review of the FCA's Crowdfunding Rules*. London: Financial Conduct Authority. https://www.fca.org.uk/publication/feedback/fs16-13.pdf (accessed 7 March 2019).

Government Accountability Office. 2011. *Person-to-Person Lending: New Regulatory Challenges Could Emerge as the Industry Grows*. Washington, DC: United States Government Accountability Office. http://www.gao.gov/new.items/d11613.pdf (accessed 10 June 2018).

Leng, S. 2016. One Third of China's 3,000 Peer-to-Peer Lending Platforms "Problematic": New Report. *South China Morning Post*. http://www.scmp.com/news/hong-kong/economy/article/2022317/one-third-chinas-3000-peer-peer-lending-platforms-problematic# (accessed 20 January 2019).

Lo, B. 2016. It Ain't Broke: The Case for Continued SEC Regulation of P2P Lending. *Harvard Business Law Review* 8. http://www.hblr.org/2016/08/it-aint-broke-the-case-for-continued-sec-regulation-of-p2p-lending/ (accessed 20 January 2019).

RateSetter. 2017. https://www.ratesetter.com/invest/everyday-account/protection (accessed 20 January 2019).

Samitsu, A. 2017. Structure of P2P Lending and Investor Protection: Analyses Based on an International Comparison of Legal Arrangements. *Bank of Japan Research Laboratory Series* 17-E-6. Tokyo.

Wildau, G. 2016. China P2P Regulations Target Hucksters and Risktakers. *Financial Times.* 24 August.

Xie Ping, Z. C., and L. Haier. The Fundamentals of Internet Finance and its Policy Implications in China. *Institute of Internet Finance Working Paper*. Beijing: Peking University.

Yin, J. 2017. P2P Lending Industry in China. *International Journal of Industrial and Business Management.* 1(4): 1–13.

Yiqing, W. 2016. Surge in P2P Scams Leads to Stronger Supervision. *China Daily*. http://europe.chinadaily.com.cn/business/2016-10/09/content_27000442.htm (accessed 20 January 2019).

CHAPTER 7

The Survival of SMEs in Thailand—New Challenges Posed by the Digital Economy and Financial Constraints

SUPPALEUK SARPPHAITOON
Akita International University and
Claremont Institute for Economic Policy Studies

7.1 Introduction

The contribution of small and medium-sized enterprises (SMEs) as engines of growth varies widely from country to country. The World Bank found that SMEs account for up to 40% of the gross domestic product (GDP) of developing countries, and this figure increases substantially if one includes informal SMEs (World Bank). In studying the survival and growth rate of SMEs in the 28 member countries of the European Union (EU-28) from 2008 to 2012, Van Beveren et al. (2015) found that SMEs accounted for nearly 100% of all enterprises.[1] Moreover, the gross value added of SMEs as a share of GDP ranges from 50.1% in Poland to 74.9% in both Estonia and Malta, and reaches an average of around 62% for the EU-28. This suggests that SMEs are the primary driver of economic growth in the EU. The same study also discovered that most enterprises are microenterprises with no more than nine employees, and most do business in the domestic market more frequently than they export products to the global market. Thus, these enterprises often remain the same size and are prone to going out of business.

On the other side of the Atlantic, in Southeast Asia, SMEs in Thailand share many characteristics with those in the EU. Thai SMEs are mostly small enterprises and do not depend on exports. Although they often find it difficult to expand due to a lack of financial access, the economic growth rate of SMEs is astonishing, in terms of both the numbers of SMEs and production values. Furthermore, business conditions have been shifting rapidly due to the advent of the internet and technological advancements, which could alter SMEs' entire business approach as well as their consumers' behavior.

[1] The EU-28 countries are Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Greece, Spain, France, Croatia, Italy, Cyprus, Lithuania, Latvia, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, the United Kingdom, and Norway.

This chapter aims to analyze the factors influencing the survival of SMEs in Thailand as well as the impact of the digital economy by applying a financial ratios analysis at the industry level, followed by a panel data analysis to solve the puzzle. I also incorporate the new features of internet banking, mobile banking, checks, and third-party fund transfers via the Bank of Thailand Automated High-Value Transfer Network (BAHTNET) system, a unique and secure large payment method that is helping Thai SMEs connect with customers and suppliers much faster and more cheaply than before. This research fills a gap in the existing literature on SMEs because most of the current work depends heavily on survey questionnaires, and does not focus on formal quantitative analysis.

7.2 SMEs in Thailand: The Backbone of Economic Growth, Government Policy, and Economic Challenges

Thailand's economy developed rapidly after the 1997 Asian financial crisis, and it has been an upper-middle income economy since 2011 (based on the World Bank's definition of gross national income per capita of at least $3,976). This achievement has been realized primarily due to the remarkable growth of SMEs in manufacturing, trade and commerce, and services. During 2006–2016, the value of SMEs' products and services constituted approximately 40% of Thailand's GDP, while that of large enterprises reached around 50% of GDP (see Table 7.1). Table 7.1, which shows GDP growth by type of enterprise, charts a rapid increase during the periods under study. In the first period (the first quarter of 2006 to the first quarter of 2011), the country's GDP grew at a rate of around 41%. Large enterprises registered the highest growth rate (38% of GDP), while that of small enterprises was around 30% and medium-sized enterprises around 34%. Growth rates in the second period are also rather noteworthy. Large enterprises continued to perform well with a growth rate of 42%, while the growth rate of medium-sized enterprises (32%) is slightly lower than in the first period. In contrast, small enterprises performed extraordinarily well in the second period, registering growth of 47%, a substantial increase of roughly 17 percentage points from the previous period—the highest growth of all enterprise groups. Thus, the contribution of small enterprises to Thailand's economy has been rising over time.

Table 7.1: Quarterly Data of Thailand's Gross Domestic Product for Selected Years

GDP by Type of Enterprise (B million)					
	Enterprise				
Year	Small	Medium	Large	SMEs	Total
Q1 2006	510,704	250,463	926,711	761,167	1,861,793
Q1 2011	663,610	336,558	1,279,390	1,000,168	2,627,098
Q1 2016	975,801	444,788	1,844,331	1,420,589	3,600,393
GDP Growth by Type of Enterprise (%)					
	Small	Medium	Large	SMEs	Total
Q1 2006–Q1 2011	29.94	34.37	38.06	31.40	41.11
Q1 2011–Q1 2016	47.04	32.16	44.16	42.04	37.05
Value of Production in Terms of GDP by Type of Enterprise (%)					
	Enterprise				
	Small	Medium	Large	SMEs	
Q1 2006	27.43	13.45	49.78	40.88	
Q1 2011	25.26	12.81	48.70	39.11	
Q1 2016	27.10	12.35	51.23	39.46	

GDP = gross domestic product, Q = quarter, SMEs = small and medium-sized enterprises.

Note: The total sum of small, medium-sized, and large enterprises' value of production as a share of GDP does not equal 100% since the agriculture sector is not included.

Source: Government of Thailand, Office of Small and Medium-Sized Enterprises Promotion.

SMEs in Thailand generate roughly four times as much employment as large enterprises, with 80% of all new positions occurring in SMEs (Table 7.2). This employment covers all of the vital economic sectors, including manufacturing, trade and commerce, wholesale and retail, and services. Further examination of the breakdown of numbers of registered SMEs and SME employment categorized by types of business reveals and confirms the considerable contribution of small enterprises to Thailand's economy. With respect to the various types of enterprise registration, nearly 75% of SME owners register their businesses as ordinary persons and employ approximately 30% of all employed persons as laborers. If one were to include the small enterprise's registration as a juristic person, the share of laborers

employed by small enterprises would more than double to about 70%. Thus, SMEs are indispensable, not only as a marketplace for Thai workers, but also as places where Thai workers can accumulate the necessary skills to set up and run their own businesses in the future. Thus, small enterprises form the backbone of economic development in Thailand.

Table 7.2: Total Number of Employed Persons Classified by Types of Business, 2013–2016

Size of enterprise	2013			2014		
	Ordinary person	Juristic person	Total	Ordinary person	Juristic person	Total
Small	4,247,383	5,024,743	9,272,126	4,247,383	5,276,387	9,523,770
Medium	120,365	837,736	958,101	120,365	852,042	972,407
Large	92,786	2,397,319	2,490,105	92,786	2,428,856	2,521,642
SMEs	4,367,748	5,862,479	10,230,227	4,367,748	6,128,429	10,496,177
Total	4,460,534	8,259,798	12,720,332	4,460,534	8,557,285	13,017,819
Size of enterprise	2015			2016		
	Ordinary person	Juristic Person	Total	Ordinary person	Juristic Person	Total
Small	4,247,383	5,518,360	9,765,743	4,884,698	5,768,927	10,653,625
Medium	120,365	860,868	981,233	131,602	961,835	1,093,437
Large	927,786	2,467,940	3,395,726	80,631	2,952,277	3,032,908
SMEs	4,367,748	6,379,228	10,746,976	5,016,300	6,730,762	11,747,062
Total	5,295,534	8,847,168	14,142,702	5,096,931	9,683,039	14,779,970
Growth of Total Employment by Type of Enterprise (%)						
Size of enterprise	2014	2015	2016			
Small	2.71	2.54	9.09			
Medium	1.49	0.91	11.44			
Large	1.27	34.66	–10.68			
SMEs	2.60	2.39	9.31			
Total	2.34	8.64	4.51			

SMEs = small and medium-sized enterprises.

Source: Government of Thailand, Office of Small and Medium-Sized Enterprises Promotion.

Abraham and Schmukler (2017) found that commercial banks required SMEs to provide at least 2 years' worth of financial statements when applying for a loan. However, as most SMEs are relatively new and informal, they often lack established records, and are thus unlikely to apply for loans. Most Thai SMEs have difficulty accessing finance due to a lack of business knowledge and a credit history. The Department of Business Development estimates that around 70% of SMEs do not have access to finance through commercial banks because they do not have a credit history and/or collateral assets. Furthermore, commercial banks are risk-averse in lending to new customers, having learned a hard lesson about nonperforming loans from the 1997 Asian financial crisis. When Thai entrepreneurs initially set up their businesses, they often depend heavily on savings and informal borrowing from relatives because they lack collateral assets and/or guarantors to help them obtain a loan from a commercial bank. With respect to this trend, Thailand is similar to many countries (Beck, Demirgüç-Kunt, and Maksimovic 2008). In 2018, the Center for Economic and Business Forecasting of the University of the Thai Chamber of Commerce conducted a survey to study the conditions of micro- and small enterprises. The results of the survey revealed that the primary sources of funding for these enterprises in setting up business are personal savings (39.61%) and money borrowed from relatives and friends (17.74%), while loans from commercial banks, government banks, and other financial institutions all together constituted only 28.21%. However, when existing enterprises need to improve their liquidity, commercial and government banks become a major source of these loans.

A common accounting practice for Thai SMEs when operating their businesses is to create two different financial accounts. The first account is for internal use and is used to record actual expenses and revenues. Business owners use this account to see the actual profit from operating the business, allowing them to adjust their business strategy as needed. The second account is used for filing their income tax returns with the Revenue Department. This common practice of "cooking the books" is broadly adopted to record low revenue and high expenses intentionally to avoid paying higher taxes. However, this business malpractice later presents a considerable hindrance for SMEs looking to expand their businesses by applying for a bank loan. When considering whether to approve a loan, commercial banks often perceive the invisibility of SMEs' cash flow and financial transactions as a negative factor and end up rejecting the loan application. If commercial banks are willing to lend funds, they often charge the SME a higher premium to offset the credit risk, thus substantially raising the cost of the SME's operation and reducing the profit earned.

7.2.1 | The Government's Policy Layout for SMEs: The Office of Small and Medium-Sized Enterprises Promotion and the Revenue Department

One influential government agency that assists and propels the expansion of SMEs in Thailand is the Office of Small and Medium-Sized Enterprises Promotion (OSMEP), which was founded in 2001 by the SMEs Promotion Act, B.E. 2543 (B.C. 2000) at the recommendation of the Ninth National Economic and Social Development Plan, 2002–2006. The OSMEP is the pillar state-owned enterprise for coordinating with think tanks and the public and private sectors to collect and disseminate data for public use through its network, and to design and implement a policy to promote and support SMEs. The OSMEP has created an SME promotion plan, renewable every 5 years. The first SME promotion plan covering the period 2002–2006 emphasized the integration of government agencies to deal with SME issues, since there was previously no government agency entirely responsible for designing, monitoring, and implementing SME policy. This made the development of SMEs inefficient in the past. The Government of Thailand aims to improve the infrastructure and logistics system, introduce e-commerce, and develop innovative technology to raise the quality and capacity of SMEs' products.

To limit the scope of its responsibility, the OSMEP classifies SMEs using the employment numbers and total fixed capital assets announced in the Royal Thai Government Gazette (see Table 7.3). Four categories—manufacturing, wholesale, retail, and services—cover most of the economic activities of SMEs in Thailand. Defining SMEs clearly is a crucial step for the OSMEP to formulate a promotion policy and provide supportive services suitable for the current economic situation and future trends. For example, the OSMEP and the Small and Medium Business Tax Administration Division of the Revenue Department can provide financial assistance and/or tax breaks to exempt or discount corporate income tax payments for eligible Thai SMEs.

As mentioned at the beginning of section 7.2, having two financial accounts not only negatively impacts both government revenue and the credit lines of SMEs, but also increases corporate transaction costs in that they have to prepare two income accounts. The Revenue Department has launched a campaign on its website to encourage new and existing SMEs to register their business as a juristic person and use a single financial account (Government of Thailand, Revenue Department). The Revenue Department also guaranteed that they would not perform backdating auditing for any SMEs that registered in this campaign between 15 January and

Table 7.3: Definition of SMEs in Thailand

Small Enterprise		
	Employed persons	Fixed capital assets (B million)
Manufacturing	50 or less	50 or less
Wholesale	25 or less	50 or less
Retail	15 or less	30 or less
Services	50 or less	50 or less
Medium-Sized Enterprise		
	Employed persons	Fixed capital assets (B million)
Manufacturing	50–200	More than 50 to 200
Wholesale	26–50	More than 50 to 100
Retail	16–30	More than 30 to 60
Services	51–200	More than 50 to 200

Source: *Royal Thai Government Gazette.* 119(93).

15 March 2016. This was a great incentive for SMEs to come out of the shadows without fear. This commercial registration offered government organizations better access to SMEs' actual data, which in turn will help them analyze the current business condition of SMEs. Thus, they can formulate and develop an appropriate policy for promoting SMEs. Table 7.4 shows the tax schedule for eligible enterprises with less than B5 million in capital and less than B30 million in revenue. As in 2016, the tax incentive provision in 2017 and 2018 exempted eligible SMEs from corporate income tax in the first year of the program and increased progressively. As a consequence, the number of registered SMEs increased noticeably in 2016. As shown in Table 7.5, the growth rate of all enterprises in 2015 was around 1%; in 2016 this increased substantially to 8.58% for small enterprises, 18.36% for medium-sized enterprises, and 26.12% for large enterprises. This is a good opportunity for new SMEs to start building their credit history by showing the actual cash flow of their business for later use in applying for loans from commercial banks.

The Government of Thailand provides collateral loan assistance or personally guaranteed loans to help startups gain access to financial loans. For example, the primary objective of the Thai Credit Guarantee Corporation, a specialized financial institution administered by the Ministry of Finance, is to reduce transaction costs

between financial institutions and small enterprises. The Thai Credit Guarantee Corporation provides a maximum of B40 million in loan guarantees without collateral for small enterprises lacking a credit history and helps commercial banks approve more loans with confidence (see Beck, Klapper, and Mendoza [2010] and Gozzi and Schmukler [2016] for further discussion of this point).

Table 7.4: Tax Schedule for Eligible SMEs

	2016	2017	2018
Net profit (baht)	Tax (%)	Tax (%)	Tax (%)
0–300,000	0	0	0
300,001–3 million	0	10	15
More than 3 million	0	10	20

Source: Government of Thailand, Revenue Department.

Table 7.5: Number and Growth of Enterprises, 2013–2016

Total Number of Enterprises (units)				
Size of enterprise	2013	2014	2015	2016
Small	2,703,393	2,723,932	2,753,038	2,989,378
Medium	12,645	12,812	12,928	15,301
Large	6,966	7,062	7,156	9,025
SMEs	2,716,038	2,736,744	2,765,966	3,004,679
Total	**2,723,004**	**2,743,806**	**2,773,122**	**3,013,704**
Growth of Total Number of Enterprises, 2014–2016 (%)				
Size of enterprise	2014	2015	2016	
Small	0.76	1.07	8.58	
Medium	1.32	0.91	18.36	
Large	1.38	1.33	26.12	
SMEs	0.76	1.07	8.63	
Total	**0.76**	**1.07**	**8.68**	

SMEs = small and medium-sized enterprises.

Source: Government of Thailand, Office of Small and Medium-Sized Enterprises Promotion.

Another example is the Small and Medium Enterprise Development Bank of Thailand, which was founded by the Small and Medium Enterprise Development Bank of Thailand Act, B.E. 2545 (B.C. 2002) under the Ministry of Industry to extend loans to SMEs. This bank offers two prominent funds, as follows:

(i) General loans (covering manufacturing, wholesale and retail, and services) are offered to SMEs with total fixed capital of less than B200 million. The loan range is B50,000–B15 million.
(ii) The aim of the SME Development Funds under the Civil State Guideline is to increase the capacity of SMEs by extending loans to enable them to buy tools and equipment and invest in capital (excluding land). The credit line per SME is up to B10 million with a fixed interest rate of 1% for up to 7 years.

7.2.3 | The Bank of Thailand: Bank of Thailand Automated High-Value Transfer Network

Thailand's central bank, the Bank of Thailand (BOT), is primarily responsible for providing surveillance and monitoring the entire financial system to ensure economic health and financial stability. On 24 May 1995, the BOT introduced a new financial infrastructure system called BAHTNET, which has since become a foundation for advanced payments of large value fund transfers. BAHTNET has contributed immensely to the Thai financial system by enabling large value fund transfers at a lower cost and reducing settlement risk in the financial system. Thai businesses traditionally made payments using cash or checks. When the value of the transaction is small, cash may be the most convenient and least risky means of making a payment; however, when a large amount of money is required, it is inconvenient and unsafe to carry cash on hand. Most businesses therefore commonly accept checks as a method of payment. This method involves both explicit and implicit costs. The obvious explicit costs are paper expenses (including checkbooks and printing paper), labor costs to prepare the check, and bank fees. Although these costs are easy to keep track of and inspect, using checks also comes with uncertainty and hidden costs, which occur during the check clearing process at the clearing houses due to check float. The length of time that it takes for a check to clear (up to 7 business days) may have a negative impact on the SME's liquidity. Another risk is that checks can bounce if the check payers have insufficient funds in their accounts.

The invention of the BAHTNET architecture has widely replaced the traditional paper-based payment system, including check payments, with a more advanced payment method that allows real-time gross settlement of large fund transfers.

Under BAHTNET, payees can receive payment immediately through fund transfers and third-party fund transfers, reducing the payment risk in the financial system enormously and encouraging the growth of SMEs.

7.2.4 | The Digital Economy and Thai Consumers' Behavior

The advent of the internet has transformed how people interact. Traditionally, merchants and consumers needed to meet and do business physically at a designated market to complete their transactions. Abraham and Schmukler (2017) pointed out that online platforms can shorten the time that it takes for SMEs to receive cash from financial institutions and can lower the risk of fraud. Furthermore, the low cost of technology has significantly lowered the price of computers and mobile phones to an affordable level. As a result, most Thai people now own computers and mobile phones and use the internet to access vendors online (and vice versa). Table 7.6 shows the number of internet users, broadband subscribers, and fixed line and mobile subscribers from 2003 to 2017 as reported by the Office of the National Broadcasting and Telecommunications Commission.

The figures in this table reveal exponential growth in the number of internet and broadband users, and a significant decline in fixed-line subscriptions. The number of fixed-line subscriptions reached a peak of 7,560,000 in 2007, before declining continuously over time. This was mainly due to a massive plunge in demand for the fixed line as a medium for a dial-up internet connection, as well as the growing popularity and affordability of mobile phones. As a result, the number of fixed-line subscriptions halved from 2007 to the end of 2017. In contrast, the number of internet users and broadband subscribers has increased since 2003, although the growth rates of both have diminished over time. Between 2007 and 2017, these numbers grew exceptionally fast, at a rate of 237% for internet users and 535% broadband subscribers. Based on statistics collected by the Department of Provincial Administration in the Ministry of Interior, at the end of 2017, Thailand had a total population of 66,188,503. This means that roughly two-thirds or 68% of the population has internet access. Finally, the number of mobile phone subscriptions grew at the very rapid rate of 70%, registering an almost two-fold increase between 2010 and 2017. In 2017, the total number of mobile subscriptions worked out to 1.84 subscribers per person, indicating that on average each person has more than one phone. This indicates that increasingly more people in Thailand are doing business online since technology has become more affordable and mobile phones allow users to connect to the internet.

Table 7.6: Internet, Broadband, Mobile, and Fixed-Line Subscriptions

Year	Internet users	Broadband subscribers	Mobile subscribers	Fixed-line subscribers
2003	6,000,000	11,611	–	7,000,000
2004	6,970,000	164,775	–	6,980,000
2005	9,909,000	555,495	–	7,290,000
2006	11,413,000	893,548	–	7,220,000
2007	13,416,000	1,293,341	–	7,560,000
2008	16,100,000	2,072,799	–	7,390,000
2009	18,300,000	2,624,278	–	7,200,000
2010	19,299,427	3,173,680	71,730,000	6,920,000
2011	21,165,365	3,781,063	77,450,000	6,660,000
2012	23,056,712	4,305,310	85,010,000	6,360,000
2013	26,140,473	4,869,246	92,940,000	6,040,000
2014	27,653,927	5,440,099	97,100,000	5,690,000
2015	39,466,260	6,229,137	102,940,000	5,310,000
2016	43,873,732	7,218,560	119,670,000	4,710,000
2017	45,189,944	8,208,235	121,530,000	3,470,000
Growth Rate (%)				
Year	Internet users	Broadband subscribers	Mobile subscribers	Fixed-line subscribers
2004	16.17	1,319.13	–	–0.29
2005	42.17	237.12	–	4.44
2006	15.18	60.86	–	–0.96
2007	17.55	44.74	–	4.71
2008	20.01	60.27	–	–2.25
2009	13.66	26.61	–	–2.57
2010	5.46	20.94	–	–3.89
2011	9.67	19.14	7.97	–3.76
2012	8.94	13.87	9.76	–4.50
2013	13.37	13.10	9.33	–5.03
2014	5.79	11.72	4.48	–5.79
2015	42.71	14.50	6.01	–6.68
2016	11.17	15.88	16.25	–11.30
2017	3.00	13.71	1.55	–26.33

Source: Government of Thailand, Office of the National Broadcasting and Telecommunications Commission.

In *Thailand Internet User Profile*, a 2017 survey of internet user behavior in Thailand conducted by the Electronic Transactions Development Agency (ETDA) under the supervision of the Ministry of Information and Communication Technology, it was reported that, on average, Thai internet users spend about 6.5 hours online every weekday and about 18 minutes more over the weekend. They surf the internet to connect to social media applications, including Line, Facebook, Instagram, and YouTube (reported by approximately 86.9% of respondents), search for information (86.5%), access e-mail (70.5%), view entertainment (60.7%), and engage in e-commerce (50.8%) (Table 7.7). The ETDA pointed out that this was the first time that e-commerce had appeared in the top five reasons for internet use. However, e-transactions are not completely distinguishable from social media, since Thai internet users also use social media to advertise, promote, and purchase products online. Thus, if this aspect of Thai internet users' behavior had been taken into account, e-commerce may have been ranked more highly. For example, online vendors often create Facebook pages to display product information, upload videos explaining the product features, or use more interactive elements such as Facebook Live. They also use Facebook Messenger to communicate with customers and request money transfers, by providing their bank account name, account number, and contact number via Messenger. After the money transfer is completed, customers send a copy of the transaction receipt to the vendor. Finally, the vendors deliver products from their home or warehouse using local couriers such as Line Man, Kerry Express, Thailand Post, and Thai Parcels.

Table 7.7: Internet Activities in Thailand, 2017

Online Activities	%	Payment Method	%	Social Media	%
Social media	86.9	Credit card	35.1	Youtube	97.1
Information	86.5	Mobile banking	31.9	Facebook	96.6
E-mail	70.5	ATM	27.1	Line	95.8
Entertainment	60.7	Internet banking	22.6		
E-commerce	50.8	Cash on delivery	14.9		

Source: Electronic Transactions Development Agency. 2017. *Value of E-Commerce Survey in Thailand 2017*. Bangkok: Electronic Transactions Development Agency.

Together with BAHTNET, the ETDA has classified electronic transactions (e-transactions) into five categories: e-payments, e-trading and services, e-certificates, e-medical records, and e-filing and e-reporting. Furthermore, types

of business transactions can also be classified into three categories: business-to-business, business-to-government, and business-to-consumer. Unlike the old business model where vendors require space to display products and many employees to carry out inventory checks and sales, Thai entrepreneurs have the alternative of selling their products online, thus saving on the costs of space rental, employees, and maintenance. The ETDA also reports that consumers are more likely to use internet banking and mobile banking through applications offered by commercial banks.

7.3 Data and the Panel Regression Models

To scrutinize the impact of the digital economy and financial constraints affecting the survival of SMEs in Thailand, this chapter uses annual data for 2010–2016 to analyze 22 industries in which Thai SMEs operate (see Table 7.8). Two criteria were used to select these 22 industries. First, as this study aims to use a sample of SMEs to obtain results that are generalizable to all Thai SMEs, the selected industries include the manufacturing, trade and commerce, and service sectors. Second, the availability of financial data for these 22 industries is relatively comprehensive compared with those of other industries, and there are a large number of firms in these industries, making such a generalization more valid. Annual financial ratio data for these SMEs at the industry level were obtained from the OSMEP, and all variables are denominated in the Thai baht. This study focuses on three categories of small enterprises, classified by total assets: small enterprises with total assets of less than B1 million (S_1), those with total assets of B1 million–B10 million (S_2), and those with total assets of more than B10 million (S_3). This approach was chosen primarily because the government, through the OSMEP, ultimately aims to promote new startup businesses and support them by providing an SME database and financial assistance. This allows new startup businesses to transform sustainably to medium-sized and large enterprises and become drivers of Thailand's economic growth. Hence, to formulate future policy, it is necessary to understand the factors affecting the survival of the industry. In addition, to compare financial ratios across industries accurately, it is appropriate to group together industries with a similar level of capitalization.

Table 7.8: Industry Classification

No.	Industry	Remark
1	Cultivation and animal husbandry	Manufacturing
10	Food manufacturing	Manufacturing
11	Beverage production	Manufacturing
13	Textiles	Manufacturing
14	Clothing	Manufacturing
15	Leather	Manufacturing
17	Pulp and paper	Manufacturing
20	Chemicals	Manufacturing
22	Rubber and plastic	Manufacturing
26	Computers, electronics, and optics	Manufacturing
27	Electronic appliances	Manufacturing
31	Furniture	Manufacturing
41	Construction (building)	Services
46	Wholesale except vehicles and motorcycles	Trade
47	Retail except vehicles and motorcycles	Trade
49	Land transportation	Services
50	Water transportation	Services
55	Hotel	Services
56	Food and beverage services	Services
59	Movie and media production	Services
68	Real estate	Services
73	Advertising and marketing research	Services

Source: Government of Thailand, Office of Small and Medium-Sized Enterprises Promotion.

This chapter adopts the conventional objective of a business—to maximize profit—as the dependent variable, and employs the net profit margin (NPM) ratio (calculated by dividing net profits by total sales) as a proxy for this business goal. The benefits of using the NPM ratio are twofold. First, it indicates how much profit a single Thai baht can generate from sales. A higher NPM ratio is preferable since it

indicates that the industry under consideration is using a good pricing strategy, such as low production costs or good sales management. This improves the cash flow of the enterprise and increase the likelihood that the business will survive. Second, the BOT, in cooperation with the Ministry of Finance and the Revenue Department, has instructed commercial banks to use SMEs' financial accounts and financial statements, which they submit to the Revenue Department when filing income taxes, as the primary documents for deciding a loan approval, effective 1 January 2019. This new lending policy will ultimately force SMEs to comply with the single financial account scheme. On the one hand, this policy is meant to help SMEs access finance by ensuring that their financial account more accurately reflects cash flow, increasing the probability that they will be able to obtain a loan. On the other hand, it helps commercial banks obtain more precise financial data as to the cash flow and liquidity of SMEs for the purposes of their lending decision, thus reducing the risk of nonperforming loans. This will help SMEs sustain a stable business in the long term. To study the sustainability and survival strategies of Thai SMEs, it is necessary to identify factors that impact the industries' NPM, namely liquidity, efficiency, profitability, and leverage. Transactions carried out through check payments, third-party transfers, internet banking, and mobile banking are also incorporated to capture the trend of SME businesses emphasizing e-transactions to support the Thailand 4.0 campaign.

Thai SMEs often have difficulty accessing finance, and even if they obtain a loan, they frequently end up paying a higher interest rate, reducing their profits. As a proxy, this study uses the interest payment to sales (*ISR*) ratio to estimate the financial hardship faced by SMEs. The lower the ISR, the lighter the financial burden carried by the enterprise. The current ratio (*CR*), computed by dividing current assets by current liabilities, is adopted to characterize the liquidity of the industry. A value greater than one means that the company can use current assets to service short-term debts. More liquidity can be expected to have a positive impact on NPM. To obtain a higher NPM, it is also necessary to factor in how the firm manages its assets to generate profit. Typically, investors can look at the return on assets (*ROA*), that is, the return on investment, to gauge the efficiency of a firm's management. The higher the *ROA*, the more efficient the firm's management. The return on equity (*ROE*) measures the profitability of the industry. Thus, an increase in the *ROA* or *ROE* ratios leads to a higher NPM. In addition to the financial ratios, I obtained mobile banking (*MBANK*) and internet banking (*IBANK*) usage data from the BOT. Both figures represent the average value of transactions in baht per total transactions. The use of internet and mobile banking will encourage more business through online channels and increase SMEs' profits because consumers find it more convenient to purchase products online. Another payment method still widely used in rural areas

is the third-party transfer (*THIRD*), measured by the value of payment transactions in baht processed through the BAHTNET system. Firms can reduce the costs of running their businesses by using more paperless transactions, such as payrolls and purchasing orders. Finally, I include the total value of checks (*CHEQUE*) used for making payments. The more an SME uses checks as a payment method, the lower its profits are expected to be. This is because there are many hidden costs attached to the use of checks, such as paper costs, time, and office supplies. All of these payment variables—*MBANK*, *IBANK*, *THIRD*, and *CHEQUE*—are transformed by using the natural logarithmic function (Table 7.9).

Table 7.9: Data Descriptions

Variable	Description	Formula	Unit
NPM	Net profit margin	Earnings after taxes/sales	%
ISR	Interest payment to sale ratio	Interest payments/sales	%
CR	Current ratio	Current assets/current liabilities	Times
ROA	Return on assets	Earnings after taxes/total assets	%
ROE	Return on equity	Earnings after taxes/total stockholders' equity	%
CHEQUE	Check payment	Ln (value of payment transaction)	%
THIRD	Third-party transfer, BAHTNET	Ln (value of payment transaction)	%
IBANK	Internet banking	Ln (average value of internet banking per transaction)	%
MBANK	Mobile banking	Ln (average value of mobile banking per transaction)	%

BAHTNET = Bank of Thailand Automated High-Value Transfer Network.

Source: Author.

To study the impact of financial ratios and e-commerce on the NPM of SME industries, I perform the analysis using the panel regression models of fixed effects and random effects. These models offer a few advantages. First, the time observed in this study is quite short. Running a regression model for each industry with six variables and a constant will consume all the degrees of freedom. Although the pooled ordinary least squares model can be used to overcome this shortfall, the pooled ordinary least squares regression completely ignores the industry-specific factor. Collecting data for 22 industries over 7 years and applying the panel

regression analysis increases the number of observations to 144 or 154, depending on the size of the total fixed assets of small enterprises. Second, the panel data analysis can capture industry-specific characteristics such as government policy, returns to scale, and risks, for which data may not be available. The fixed-effect model can be written as

$$NPM_{it} = \beta_{0i} + \beta_1 ISR_{it} + \beta_2 CR_{it} + \beta_3 ROA_{it} + \beta_4 ROE_{it} + \beta_5 THIRD_{it} + \beta_6 CHEQUE_{it} + \beta_7 IBANK_{it} + \beta_8 MBANK_{it} + U_{it} \quad (1)$$

where i represents the ith industry (cross-sectional unit from i = 1, 2, 3, ..., N) and t represents the time period (i = 1, 2, 3, ..., T). The fixed-effects model in Equation (1) allows a change in the intercept terms, β_{0i}, for every industry but not across the time horizon. U_{it} is a Gaussian white-noise error term. While the random-effects model will make a slightly different assumption regarding the intercept terms, β_{0i} is now assumed to be random with the mean value of β_0, and the intercept for each industry is given by

$$\beta_{0i} = \beta_0 + \varepsilon_i \quad (2)$$

where ε_i is also a Gaussian white-noise error.

Therefore, the random-effects model can be represented by substituting Equation (2) into (1) to obtain

$$NPM_{it} = \beta_0 + \beta_1 ISR_{it} + \beta_2 CR_{it} + \beta_3 ROA_{it} + \beta_4 ROE_{it} + \beta_5 THIRD_{it} + \beta_6 CHEQUE_{it} + \beta_7 IBANK_{it} + \beta_8 MBANK_{it} + \varepsilon_i + U_{it} \quad (3)$$

or

$$NPM_{it} = \beta_0 + \beta_1 ISR_{it} + \beta_2 CR_{it} + \beta_3 ROA_{it} + \beta_4 ROE_{it} + \beta_5 THIRD_{it} + \beta_6 CHEQUE_{it} + \beta_7 IBANK_{it} + \beta_8 MBANK_{it} + W_{it} \quad (4)$$

where

$$E(W_{it}) = 0$$
$$Var(W_{it}) = \sigma_\varepsilon^2 + \sigma_U^2$$
$$Corr(W_{it}, W_{is}) = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_U^2}$$

7.4 Results and Discussion

Table 7.10 shows the empiric results of the panel regression models of three categories of small enterprises (S_1, S_2, and S_3). For each category, the fixed- and random-effects models are reported with and without the robust standard error. The panel data models I and II comprise all financial ratios and traditional payments (including third-party transfers and check payments), and serve as the base models for a robustness check and comparison after adding the proxy variables to capture the advent of the digital economy. The panel analysis models III and IV expand the base models by adding internet banking and mobile banking transactions. The total number of observations (144) in S_1 is slightly lower than in S_2 and S_3 due to missing data.

The regression results of S_1 are unanticipated because the coefficients of *ISR*, *CR*, *THIRD*, *CHEQUE, IBANK*, and *MBANK* have opposite signs, contradicting the suggestion of the theory. Furthermore, most coefficients are not statistically significantly different from zero at all conventional levels of 1%, 5%, and 10%, except for the coefficient of *ROA*, which also has a correct anticipated sign. Thus, an improvement in the management of assets (*ROA*) will improve the NPM. The magnitude of this improvement due to a 1% increase in *ROA* depends on the choice of the models. The coefficients of *ROA* are approximately 1.55% for Model I and 1.52% for Model III in the fixed-effects models, and slightly lower in the random-effects models, at 1.29% for Model II and 1.27% for Model IV. However, when applying the robust standard error for the fixed and random effects in all considered models, the coefficient of *ROA* is statistically significant at 15%. These unlikely panel regression results may arise from inaccurate data reported to government officials, mainly due to accounting malpractice.

Unlike the regression results of S_1, the panel regression results of S_2 and S_3 have enriched noticeably, and in many different ways. The signs of coefficients now appear to be accurately suggested by the theory, and they do not vary among the four models, regardless of whether or not the robust standard error is applied. Furthermore, the magnitude of the coefficients is perceivable and can be interpreted economically. An examination of the panel data models of S_2 in models I and II reveals that the coefficient of *ISR* in the fixed-effects model is significant at the 1% level, but not significant in the random-effects model. A 1 percentage point increase in *ISR* will reduce *NPM* by approximately 0.59 percentage points. This magnitude makes economic sense since small enterprises have difficulty obtaining loans from commercial banks. Instead, the owners of small enterprises depend on borrowing

from loan sharks, which mark up the interest rate differential by approximately 10 percentage points compared with the typical interest rate in the market. The result of the regression suggests that *NPM* would decline by approximately 6 percentage points. Unfortunately, in the random-effects model the same coefficient is not statistically significant from zero. While the results of S_3, the signs of the *ISR* coefficients are as expected, the size of the impact of *ISR* on *NPM* declines approximately five times in the fixed effects of Model I, but remains roughly the same in the random effects of Model II. The *ISR* coefficient may be smaller because larger small enterprises have gained more financial access through commercial banks, as they have a long-established financial history (Abraham and Schmukler 2017).

Table 7.10: Panel Regression Results for Small Enterprises

	S1							
	I		II		III		IV	
	FE	FE robust	RE	RE robust	FE	FE robust	RE	RE robust
Constant	122.4147[a]	122.4147**	121.7004[b]	121.7004**	316.6672[b]	316.6672[b]	302.9007[b]	302.9007[b]
	(80.6245)	(47.2968)	(80.1657)	(49.6947)	(227.2805)	(233.4860)	(226.3587)	(236.2793)
Interest to sale ratio	0.0023	0.0023***	0.0021	0.0021***	0.0022	0.0022**	0.0021	0.0021**
	(0.0020)	(0.0008)	(0.0020)	(0.0008)	(0.0020)	(0.0009)	(0.0020)	(0.0010)
Current ratio	–0.3150	–0.3150	–0.2812	–0.2812	–0.3089	–0.3089	–0.2738	–0.2738
	(0.4172)	(0.4443)	(0.3419)	(0.3347)	(0.4226)	(0.4381)	(0.3450)	(0.3322)
ROA	1.5492***	1.5492[a]	1.2919**	1.2919[a]	1.5190***	1.5190[a]	1.2677**	1.2677[a]
	(0.5697)	(0.9460)	(0.5112)	(0.8408)	(0.5738)	(0.9317)	(0.5145)	(0.8213)
ROE	0.6050	0.6050	1.2696[b]	1.2696[b]	0.5015	0.5015	1.2037	1.2037
	(1.0869)	(1.8812)	(0.9533)	(1.5222)	(1.0974)	(1.8916)	(0.9602)	(1.5050)
Ln (third)	–19.1507***	–19.1507**	–19.3631***	–19.3631**	–19.5432***	–19.5432*	–19.4264***	–19.4264*
	(6.1202)	(8.5925)	(6.0488)	(8.5879)	(7.3878)	(11.3120)	(7.2814)	(11.2408)
Ln (check)	11.9337	11.9337	12.2382	12.2382	13.4941	13.4941	11.4198	11.4198
	(13.4728)	(15.0390)	(13.3820)	(14.5586)	(37.0869)	(40.8643)	(36.9477)	(40.3061)
Ln (internet banking)					–9.9462	–9.9462	–9.0662	–9.0662
					(12.1822)	(13.9387)	(12.1295)	(13.8767)
Ln (mobile banking)					–1.1173	–1.1173	–0.3151	–0.3151
					(11.7718)	(11.0274)	(11.7303)	(10.9379)
Number of observations	144	144	144	144	144	144	144	144
Number of industries	22	22	22	22	22	22	22	22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

continued next page

Table 7.10: ***Continued***

	S2							
	I		II		III		IV	
	FE	FE robust	RE	RE robust	FE	FE robust	RE	RE robust
Constant	−20.5543***	−20.5543***	−24.9173***	−24.9173***	−54.6483***	−54.6483***	−49.3012**	−49.3012***
	(7.2588)	(6.6673)	(8.4575)	(9.0165)	(19.9543)	(14.1543)	(23.3882)	(11.9056)
Interest to sale ratio	−0.5878***	−0.5878***	−0.1914	−0.1914	−0.6144***	−0.6144***	−0.2316	−0.2316
	(0.2028)	(0.1810)	(0.2304)	(0.3514)	(0.1966)	(0.1832)	(0.2259)	(0.3194)
Current ratio	0.5638***	0.5638***	0.5303***	0.5303***	0.4954***	0.4954***	0.4921***	0.4921***
	(0.0678)	(0.1236)	(0.0697)	(0.1365)	(0.0673)	(0.1260)	(0.0697)	(0.1309)
ROA	0.6961***	0.6961***	0.5728**	0.5728**	0.6126***	0.6126**	0.4914*	0.4914**
	(0.2459)	(0.2586)	(0.2746)	(0.2459)	(0.2350)	(0.2294)	(0.2666)	(0.2275)
ROE	0.0972	0.0972	0.0665	0.0665	0.2050[b]	0.2050	0.1697	0.1697
	(0.1630)	(0.2068)	(0.1880)	(0.2355)	(0.1585)	(0.2061)	(0.1848)	(0.2453)
Ln (third)	0.7960	0.7960	0.6483	0.6483	2.2316***	2.2316**	1.8336**	1.8336**
	(0.6385)	(0.8146)	(0.7122)	(0.8126)	(0.7027)	(0.9652)	(0.7826)	(0.8854)
Ln (check)	1.1452	1.1452	1.9415[a]	1.9415[b]	−9.5807***	−9.5807***	−7.7711**	−7.7711***
	(0.3397)	(1.3977)	(1.3502)	(1.3894)	(2.8771)	(3.1670)	(3.3474)	(2.9665)
Ln (internet banking)					2.4756**	2.4756***	1.9629[a]	1.9629***
					(1.0218)	(0.8675)	(1.2000)	(0.6011)
Ln (mobile banking)					3.8477***	3.8477***	3.4784***	3.4784***
					(0.9520)	(0.9590)	(1.1153)	(0.9584)
Number of observations	154	154	154	154	154	154	154	154
Number of industries	22	22	22	22	22	22	22	22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

continued next page

The *CR* and *ROA* are also statistically significantly different from zero at the conventional significance levels for the fixed- and random-effects models for both S_2 and S_3. To maintain their businesses in good condition, maintain high profits, and improve their financial liquidity, small enterprises must employ an efficient and effective management strategy. A high value of *CR* indicates a company's superior ability to use current assets to cover its short-term liability obligation. In S_2, a one-fold increase in *CR* leads to a rise of 0.53–0.56 percentage points in the *NPM*.

Table 7.10: ***Continued***

	S3							
	I		II		III		IV	
	FE	FE robust	RE	RE robust	FE	FE robust	RE	RE robust
Constant	−13.7035***	−13.7035***	−13.0989***	−13.0989***	−20.4363*	−20.4363*	−18.1797*	−18.1797[a]
	(3.7226)	(4.4861)	(3.8099)	(4.3060)	(10.8240)	(10.8522)	(11.0300)	(11.5165)
Interest to sale ratio	−0.1249**	−0.1249[a]	−0.1743***	−0.1743**	−0.1285**	−0.1285[b]	−0.1772***	−0.1772*
	(0.0594)	(0.0812)	(0.0569)	(0.0821)	(0.0593)	(0.0894)	(0.0567)	(0.0917)
Current ratio	0.5384**	0.5384**	0.7064***	0.7064**	0.5507**	0.5507**	0.7271***	0.7271**
	(0.2506)	(0.2586)	(0.2248)	(0.2987)	(0.2534)	(0.2607)	(0.2469)	(0.3208)
ROA	0.6584***	0.6584***	0.6712***	0.6712***	0.6221***	0.6221***	0.6332***	0.6332***
	(0.1310)	(0.1668)	(0.1297)	(0.1571)	(0.1322)	(0.1584)	(0.1307)	(0.1495)
ROE	0.0327	0.0327	0.0631	0.0631	0.0546	0.0546	0.0858[b]	0.0858[b]
	(0.0615)	(0.0692)	(0.0617)	(0.0564)	(0.0627)	(0.0691)	(0.0628)	(0.0614)
Ln (third)	0.3325	0.3325	0.2957	0.2957	0.5714*	0.5714*	0.5470*	0.5470*
	(0.3001)	(0.2866)	(0.3033)	(0.2976)	(0.3285)	(0.3161)	(0.3319)	(0.3172)
Ln (check)	1.0131*	1.0131[a]	0.9414[a]	0.9414*	−1.4142	−1.4142[a]	−1.6432	−1.6432*
	(0.5973)	(0.5996)	(0.6087)	(0.5302)	(1.5146)	(0.8295)	(1.5443)	(0.9815)
Ln (internet banking)					0.5387	0.5387	0.4697	0.4697
					(0.5498)	(0.4833)	(0.5612)	(0.5191)
Ln (mobile banking)					0.8920*	0.8920**	0.9418*	0.9418**
					(0.5089)	(0.3618)	(0.5197)	(0.4178)
Number of observations	154	154	154	154	154	154	154	154
Number of industries	22	22	22	22	22	22	22	22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

* = p<0.1, ** = p<0.05, *** = p<0.01, FE = fixed effects, RE = random effects, ROA = return on assets, ROE = return on equity.

[a] p<0.15, [b] p<0.20.

The impact of *CR* in S_3 is similar in the fixed-effects model, but the magnitude of 0.71 is slightly higher in the random-effects model. Moreover, an improvement in asset management will lead to higher profits. A change of 1 percentage point in *ROA* will increase *NPM* by 0.57–0.70 percentage points in S_2 and around 0.66–0.67 percentage points in S_3. *ROE* has a correct sign, but is not statistically significant. This may be due to the difference in calculation between *ROA* and *ROE*. Unlike *ROE*, *ROA* includes all types of assets including account receivables, inventories, and land.

It is better suited to reflect the nature of small Thai enterprises, which are generally registered under sole proprietorship. Thus, shareholders' equity may be too narrow to capture the full picture of small enterprises. Without internet and mobile banking, it is anticipated that check payments will play a greater role in the financial system, and this effect should be positively related to the firm's profit. This is due to its safety and convenience for large transaction values. Unfortunately, *THIRD* is not statistically significant in either S_2 or S_3, while *CHEQUE* is only statistically significant in S_3.

To understand the influence of the digital economy on small enterprises, the control variables, *IBANK* and *MBANK*, are included in models III and IV. The signs and coefficients of all financial ratios are not much different from models I and II for both S_2 and S_3. Nevertheless, *ROE* remains not statistically significant at all conventional levels. *THIRD* is statistically significant at the 5% level, and an increase of 10 percentage points in the value of third-party payments increases *NPM* by 0.18 percentage points in the fixed-effects model in S_2. However, *NPM* only rises by approximately 0.05 percentage points in S_3, less than initially expected. Another striking result is that *CHEQUE* has a negative sign after the advent of digital economy, and an increase of 10 percentage points in the value of check payments reduces *NPM* by 0.77–0.96 percentage points (depending on the choice of the panel regression model), and by 0.16 percentage points in Model IV with the robust standard error. Further, online payments through internet and mobile banking are helping firms improve their performance in S_2. The coefficients of *IBANK* and *MBANK* are statistically significant from zero and have sensible magnitudes. A rise of 10 percentage points in *IBANK* will increase *NPM* by 0.2 percentage points, while the same increase in *MBANK* will increase *NPM* by 0.3 percentage points. Nonetheless, in S_3 *IBANK* is insignificant, while an increase of 10 percentage points in *MBANK* will reduce *NPM* by around 0.09 percentage points.

What can we learn from this SME empirical model? First, entrepreneurs must be careful in choosing how to finance their businesses. High interest payments relative to revenue expose a firm to the risk of going out of business, since the company is financed by debt. One solution is to participate in the "one business one financial account" campaign, which can make an enterprise's cash flow more visible. This increases the likelihood that, when the entrepreneur needs to apply for loans from a commercial bank, the loan will be approved. Moreover, after registering with this program, the enterprise will be eligible for many cheap SME promotion loans provided by the Special Financial Institutions, and will be able to access information for SME services provided by the government. Another potential solution is good managerial skills, which are essential for a business to survive. As shown by the *CR* and *ROA* results, a firm owner must increase revenue and decrease unnecessary expenses

to increase profit. The advent of the internet and the improvement of e-transaction infrastructure through BAHTNET have dramatically lowered the cost of operating a business. The company or enterprise needs fewer workers to perform necessary tasks such as sales, payroll, and storefront customer service. Furthermore, the company can advertise its products and services on its website or on social media platforms popular in Thailand such as Facebook, YouTube, and Pantip. SMEs should also avoid using checks as a payment method, because they involve many hidden costs, such as those of paper, labor, and time; check float; and high transaction fees. Instead, SMEs should consider using e-payments such as third-party transfers, ATMs, and mobile banking, which are convenient and have lower transaction fees. A handful of Thai SMEs still prefer using checks for many reasons. For instance, SMEs offer longtime and trustworthy customers in-house lines of credit, by allowing them to complete the transaction and obtain the desired products or services while postdating the check used to make the payment. The SME will hold the check and cash it on the specified date. If the check then bounces this is a criminal offense. Finally, since Thai people use mobile phones heavily in their everyday lives, it is worthwhile for SMEs to develop user-friendly applications to supplement their offline stores.

7.5 Concluding Remarks

The digital economy has introduced many new features, opportunities, and challenges for SMEs. One of its most significant advantages is that it reduces transaction costs. The internet eliminates the problem of inferior store locations and markets, because consumers can now choose to shop either online or offline, almost 24/7, and from anywhere. Furthermore, due to the support of the BOT through the architecture of the BAHTNET system, e-payments and e-money transfers are now much more common and safe, and the cost per transaction is significantly lower than that of using checks. As the cost of technology (especially smartphones and mobile devices) declines, and Thai consumers spend ever more time carrying out various activities on their mobile devices, SMEs should take these trends into account while extending their channels to reach more consumers. A knowledge of finance will help SME entrepreneurs evaluate the condition of their own businesses. This chapter emphasizes two things. First, SMEs should lower their interest burden by using a single financial account. Doing so will allow them to record actual business financial activities in a given fiscal year, which will in return provide them with more information when applying for loans. Furthermore, eligible SMEs can gain access to many government promotion campaigns through the OSMEP. Second, SMEs can reach more consumers by selling products online and offering various payment methods.

References

Abraham, F., and S. L. Schmukler. 2017. Addressing the SME Finance Problem. *Research and Policy Briefs*. Washington, DC: World Bank.

Bank of Thailand. 2018. *Disclosure Report on BAHTNET Self-Assessment against the Principles for Financial Market Infrastructures*. Bangkok: Bank of Thailand.

Beck, T., A. Demirgüç-Kunt, and V. Maksimovic. 2008. Financing Patterns around the World: Are Small Firms Different? *Journal of Financial Economics.* 89(3): 467–487.

Beck, T., L. F. Klapper, and J. C. Mendoza. 2010. The Typology of Partial Credit Guarantee Funds around the World. *Journal of Financial Stability.* 6(1): 10–25.

Center for Economic and Business Forecasting. 2018. *Financial Access of Thai SMEs*. Bangkok: University of the Thai Chamber of Commerce.

Department of Business Development. 2017. *Thailand Internet User Profile 2017*. Bangkok: Ministry of Digital Economy and Society.

Electronic Transactions Development Agency. 2017. *Value of E-Commerce Survey in Thailand 2017*. Bangkok: Electronic Transactions Development Agency.

Government of Thailand. Revenue Department. http://www.rd.go.th (accessed 5 March 2019).

Gozzi, J. C., and S. L. Schmukler. 2016. Public Credit Guarantees and Access to Finance. *Warwick Economics Research Paper Series*.

Van Beveren, I., M. Luppes, L. Rozendaal, M. Walthouwer, P. Alajääskö, and A. Roodhuijzen. 2015. *Statistics on Enterprise Survival and Growth Prospects between 2008 and 2012*. Luxembourg: Eurostat.

World Bank. *Small and Medium Enterprises (SMEs) Finance: Improving SMEs' Access to Finance and Finding Innovative Solutions to Unlock Sources of Capital*. Washington, DC: World Bank. https://www.worldbank.org/en/topic/smefinance (accessed 5 March 2019).

CHAPTER 8

The Role of Digital Payments Fintech in Accelerating the Development of MSMEs in Indonesia

NIKA PRANATA
Indonesian Institute of Sciences (LIPI)

8.1 Introduction

The world, including Indonesia, is entering the Industry 4.0 era in which optimization has been utilizing the technology of artificial intelligence, big data, and Internet of Things (Wahlster 2012). In such era, innovation has a key role in creating products and services. A product/service is evaluated not only by its function or utility but also by its convenience of use, delivery time, and efficiency. Therefore, it has positive values that differ with products/services from previous eras.

Massive innovation also happens in the finance sector, including payment systems whose recent innovation is in the form of digital payments. With such platform, people no longer need to pay using cash or card. Payments can be made by only using cellular/internet connection and smartphone, known as a cloud- or server-based payment system. This system has several advantages over electronic money–based cards; it can store data and transaction records over the internet (cloud based). If the sim card or hand phone used as e-wallet is lost, the electronic money stored in it is not necessarily lost as long as access to the sim card is regained. If the money-based electronics card is lost, then the electronic money stored cannot be obtained again.

Digital payments have immense potential to be widely used in Indonesia as over 140 million people in the country, 93% of whom have smartphone or tablet devices, use the internet. Furthermore, the majority (74%) of internet users in Indonesia are between 19 and 34 years, generally technology literate, and are highly mobile (APJII 2017). Such high potential market has encouraged the perpetrators of the financial industry to innovate to meet the needs of consumers who require payment systems to be more efficient, practical, instant (one-touch payment), and secure (Boston Consulting Group and Google 2016). Digital payments also have a wide room to be used in Indonesia as majority of its society still rely on cash in making payments.

According to Bank Indonesia, about 99.4% of retail transactions are still paid in cash, leaving the country behind its neighbors in Southeast Asia such as Thailand (97.2%), Malaysia (92.3%), and Singapore (55.5%) (Remon 2016; Ferdian 2017).

Furthermore, digital payments do not only benefit individuals but also positively affect the development of micro-, small, and medium-sized enterprises (MSMEs). Adiseshann (2018) and Deloitte (2018) have pointed out several benefits to MSMEs of digital payments system:

(i) **Safer and faster payment.** Digital payments can reduce transaction cost as paper-based payment involves manual processes and takes many steps to complete.
(ii) **Better customer experience.** Unlike paper-based payment that requires customers to bring cash everywhere, with e-wallet, they only need to bring their mobile phone. It is more convenient for customers as making a payment takes only one click. Customers also do not have to provide several denominations to pay an exact amount; sometimes getting small denominations of money is quite cumbersome.
(iii) **Increased transparency and well-managed bookkeeping.** Every payment transaction using digital payments is automatically recorded on the server. Therefore, without manual recording, MSMEs can access their transaction record and have neat and accurate bookkeeping.
(iv) **Deliver competitive advantage.** As payment becomes borderless, MSMEs can access overseas markets through the digital payments platform used globally, such as PayPal (ConnectAmericas 2015). MSMEs can also create value-added services, such as customer loyalty programs/rewards, since they can analyze their customers' profile and behavior like their spending profile and behavior.

However, although digital payments benefit MSMEs, still, in the case of Indonesia, there is very limited research in investigating the impact of digital payments on MSMEs businesses. Therefore, this study aims to examine empirically the role of digital payments financial technology (fintech) in accelerating the development of MSMEs uses evidence from Nusa Tenggara Barat (NTB) and Bali.

8.2 Literature Review

8.2.1 | Definition and Authority of Payment System in Indonesia

Bank Indonesia defines payment system as one related to the transfer of a certain amount of money from one party to another. The forms of media used for the transfer process can vary greatly from very simple payment instruments to complex systems involving various institutions. Furthermore, Bank Indonesia is responsible for regulating and maintaining the smoothness of all aspects related to the payment system in Indonesia. In carrying out its mandate, the bank applies four principles of payment system policy: security, efficiency, equality of access, and consumer protection. Security principles relate to mitigation of any risks in the payment system including liquidity, fraud, credit, and others. The efficiency principle aims to provide an affordable payment system by utilizing economies of scale to be used by the public. Furthermore, the principle of equality of access guarantees that the payment system is not monopolized. Any payment service provider has the same rights and is not charged with differences in terms and conditions of the market that may inhibit (barrier to entry) prospective payment system providers to participate in the market. Finally, consumer protection is the main task of Bank Indonesia in maintaining and ensuring the security of public money transfers conducted through a payment system (Bank Indonesia 2013).

8.2.2 | Definition of Digital Payments Financial Technology

Fintech is a phrase composed of two words, financial and technology. Therefore, it literally means financial technology. More broadly, fintech is a company or part of a company that combines modern financial services with innovative technology (Dorfleitner et al. 2017). Generally, fintech attracts consumers through its internet-based products or services usually using web or applications that are more efficient, transparent, and automated. Those features differentiate fintech services from conventional financial services. As for Indonesia, Bank Indonesia uses the term "TekFin" (*Teknologi Finansial*) to replace its English term (fintech). In the Regulation of the Board of Governors (PADG) No. 19/15/ PADG/2017 on the Procedures for Registration, Delivery of Information and Monitoring of Financial Technology Services, Bank Indonesia defines "TekFin" as (i) the use of technology in the

financial system that produces products, services, and/or new business models; and (ii) impacts monetary stability, financial system stability, and/or efficiency, smoothness, security, and reliability of the payment system.

Therefore, combining those two definitions, digital payments system fintech is one related to the transfer of a certain amount of money from one party to another using innovative technology. Dorfleitner et al. (2017) classifies digital payment fintech into three categories: alternative payment methods, cryptocurrency, and other payment fintech. Furthermore, alternative payment methods generally include payment and transfer using electronic money either by card or mobile phone and/or the internet. The other category is cryptocurrency that uses blockchain technology such as bitcoin, ripple, etherium, and other crypto currencies, while the third category is other payment system that does not fall into the first and second categories.

8.2.3 | Classification of Digital Payments Fintech

Electronic payment method is divided into two categories: (i) card/chip based such as e-toll, Mandiri e-money, BCA Flazz, BRIZZI, and others; and (ii) server-based/cloud-based such as Mandiri E-Cash, Go-Pay, T-Cash, OVO, YAP, and DOKU Chip-based payment methods are functionally like fiat money which means that if the card is lost, the nominal money stored there will also be lost. For server-based payment method, if the mobile phone, SIM card, or other media used as a means of payment is lost, the nominal money stored still exists as long as the customer can regain access to the mobile phone number or other identity used as the e-wallet ID. More detailed differences of those digital payment types are presented in Table 8.1. Furthermore, this study will only examine server-based digital payments system.

8.3 Research Location, Data, and Respondents' Characteristics

This research was conducted in two provinces, Nusa Tenggara Barat (NTB) and Bali. These locations were selected because both depend on tourism as a backbone of the economy. The Mandalika area of the NTB was chosen as a special economic zone being developed by the Indonesia Tourism Development Cooperation (ITDC). Bali, particularly Nusa Dua that was also developed by the ITDC, was chosen as a best practice tourism special economic zone.

Table 8.1: Types of Digital Payments Systems

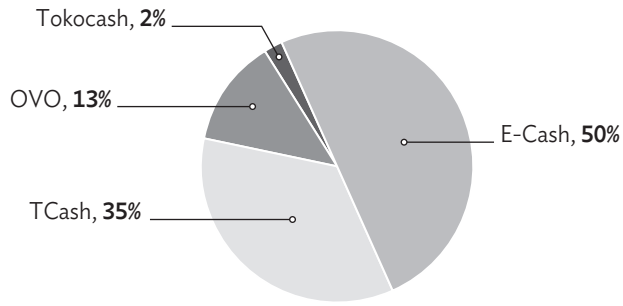
Aspect	Server based	Chip based
Medium	Internet connected devices (mobile phone, laptop, PC)	Chip-planted cards
Top up channels	Electronic Data Capture (EDC), ATM, Bank Transfer, Agents, Retailers	
Top up fees	Rp0–Rp1,500 depending on top up channels	Rp200–Rp1,500 depending on top-up channels
Payment method	Virtual (QR Code, click and pay, etc.)	EDC-based
Balance storage	Payment provider's server	Stored in chip-planted card
Balance limit	– Rp1 million for users that have not yet registered and been verified by Bank Indonesia – Rp10 million for users registered and verified by Bank Indonesia	Rp1 million for all users
Service limit	– Remittance/transfer – Cash withdrawal – Online and offline payment	– Cash withdrawal – Offline payment
Example of payment products	Go-Pay, Mandiri E-Cash, T-Cash, Doku, OVO	E-money, Flazz, Brizzi

Source: Pratama (2018).

Respondents selected through purposive sampling totaled 46; 25 of them were from the NTB and 21 from Bali. All respondents must have an account of cloud-based e-payment and have a business whether as an entity or individual. Out of 46 respondents, 23 of them are Mandiri e-Cash users, 16 are Telkomsel Cash (T-CASH), 6 OVO users, and 1 TokoCash user. Later, instead of locations, the data description and analysis will be based on two categories of fintech characteristics: e-cash and general, which are fintechs other than e-cash including T-CASH, OVO, and TokoCash.

E-cash is a separate category because e-cash services reach customers through partnership with a cooperative named "Wira Singa" in a village of Lombok Barat, NTB whereas the remaining respondents using general fintechs are mainly merchants in urban areas with relatively good internet quality. Some of Wira Singa's members, including farmers and small retailers, are encouraged to open e-cash accounts by offering benefits and privileges. E-cash also does not require smartphone and internet access; the transaction can be done via conventional phone and Unstructured Supplementary Service Data (USSD) code. General fintech respondents mainly use EDC/QR code with internet as a media.

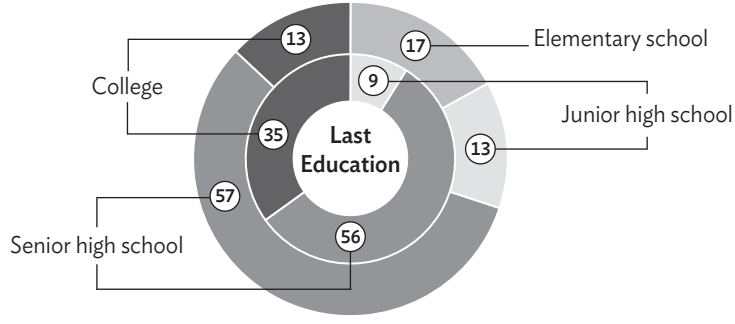
Figure 8.1: Respondents' Fintech Provider



Source: Author's calculation based on survey data.

Furthermore, the average age of respondents is 30.5 years old, consisting of 33.5 years old of e-cash users and 27.4 years old of general fintech users. From this data, we can see that majority of fintech users in this study are young. This figure is also in line with the market mapping of Indonesia fintech users reported in the Indonesia Fintech Report 2016 (Indonesia FinTech Association and Daily Social Indonesia 2016). In terms of education, general fintech users have a better education profile: 35% of them graduated from college and the least education they finished is junior high school. On the other hand, only 13% of e-Cash users have a college degree and 17% did not finish elementary school (Figure 8.2).

Figure 8.2: Composition of Respondents' Educational Level (%)

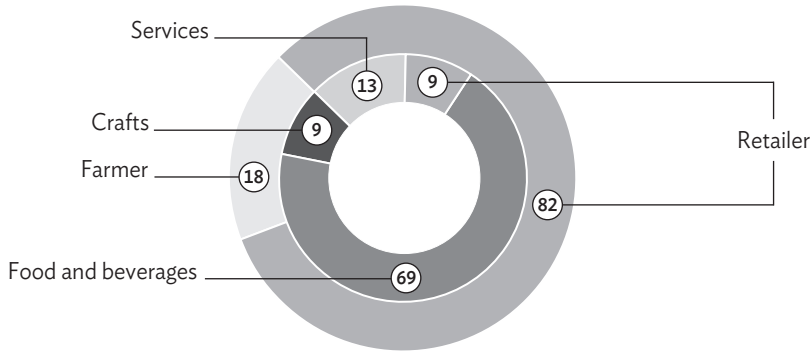


Outer circle = e-Cash, Inner circle = General.

Source: Author's calculation based on survey data.

Moreover, on the business or job type, majority of general fintech respondents work in the food and beverages sector (69%) (Figure 8.3). This sector involves a lot of payment transactions and is recipient of considerable amounts of fintech providers' offers and promotions. This is followed by the services (13%), crafts, and retailer sectors (both at 9%). E-Cash users are either small retailers (82%) or farmers (18%).

Figure 8.3: Respondents' Job Composition *(%)*

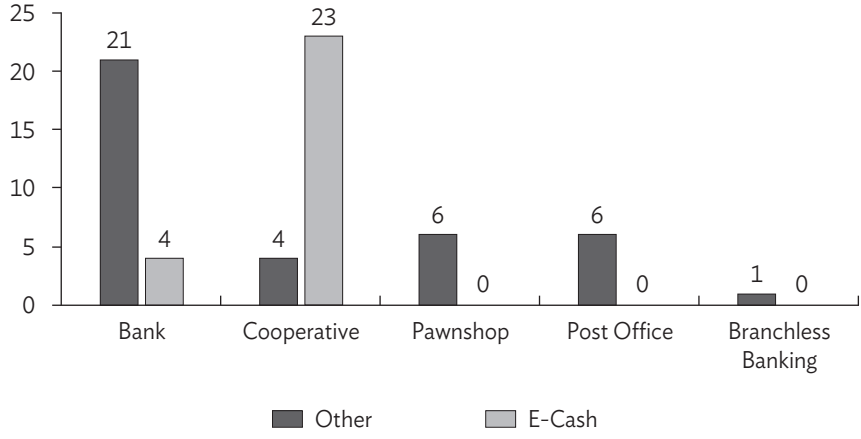


Outer circle = e-Cash, Inner circle = General.
Source: Author's calculation based on survey data.

Respondents were also asked of the nearest financial institutions in their neighborhood, comprising bank, cooperative, pawnshop, post office, and branchless banking. The results are different between the two groups (Figure 8.4). Majority of E-Cash users answered cooperative as the closest financial institution in their area, whereas only a few of them think bank is their nearest financial institution. In contrast, general fintech users mostly answered bank as their closest financial institution. The reason for such answer is that majority of general fintech users are in cities compared to E-Cash users who live in villages.

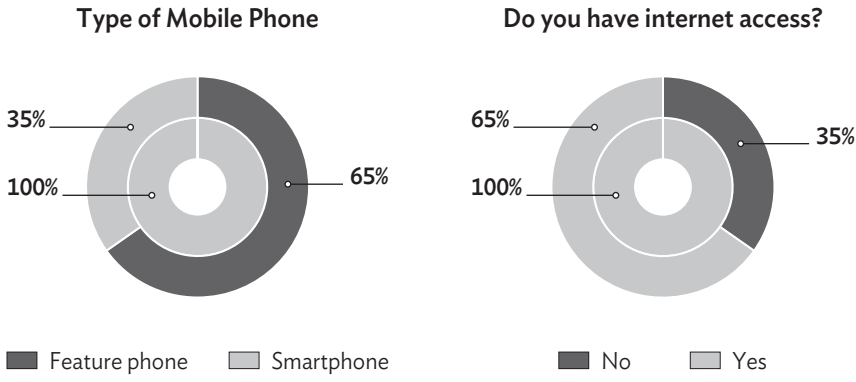
In terms of technological devices and media, all respondents have at least a mobile phone. However, noticeable differences are (i) all general fintech users own a smartphone, whereas majority of E-Cash users (65%) still rely on a feature phone, one used only for calling and messaging through short message services (SMS) without using the internet; (ii) each general fintech user has access to the internet, whereas 35% of E-Cash users do not have access to it. This implies that E-Cash services can be done using only a feature phone and without internet connection.

Figure 8.4: Nearest Financial Providers (Number of Answers)



Source: Author's calculation based on survey data.

Figure 8.5: Respondents' Mobile Phone Type and Internet Access



Outer circle = e-Cash, Inner circle = General.

Source: Author's calculation based on survey data.

8.4 Methodology

To investigate the role of digital payments fintech in accelerating the development of MSMEs, this study mainly uses qualitative analysis of the primary data obtained through questionnaires from the NTB and Bali. This data is analyzed and presented in descriptive statistics to show accessibility and impact of fintech to MSMEs' development, including its obstacles, services evaluation, and other aspects. This study further analyzes the descriptive statistics finding and its justifications as well as filling the gap of information not covered in the questionnaire. Qualitative data is gathered through field observation, focus group discussions, and in-depth interviews with stakeholders, digital payments fintech providers and users, Indonesia Financial Services Authority, Central Bank of Indonesia, Ministry of Communication and Information, local governments, and other stakeholders.

8.5 Digital Payments Fintech and Its Role in Accelerating the Development of MSMEs

8.5.1 | Findings of Field Observation

In general, digital payments fintech services have reached the NTB and Bali although these are not as widely used in the NTB as in big cities such as Jakarta, Bandung, and Surabaya. For instance, NTB people and Go-Food merchants use Gojek-Pay (Go-Pay) since both major players of ride-hailing in Indonesia, Go-Jek and Grab, have entered the NTB even though these are only available in the province's capital city, Mataram. Excluding Go-Pay, majority of digital payments providers, such as OVO, T-Cash, and BNI's YAP, in the NTB are available in food and beverages merchants; however, these are limited only in well-known chain restaurants and merchants in malls.

They generally attract customers to use their payment platforms by offering cash backs and discounts. For instance, OVO offers a 10%–30% cash back to customers paying their bills in their partner restaurants. This cash back can be used for later transactions. Another example is T-Cash that offers a special price, lower than its regular price, for selected Chatime drinks on the condition that they pay using T-Cash. In addition, T-Cash also has a feature called "SMS Blast" that can promote or advertise its partner business. This feature allows Telkomsel, the largest cellular provider in Indonesia, to advertise through SMS whenever its subscribers are in a

certain radius to T-Cash merchant partners. For instance, within a 1-kilometer radius to Dunkin Donuts whose chain is partnered with T-Cash, Telkomsel will "blast" its advertising SMS to its users. The content of the SMS mainly promotes Dunkin Donuts.

Regarding the depth of people's use and understanding, in general, in both the NTB and Bali, majority of people still do not know about, and do not use, digital payments. Local governments also have limited understanding of digital payments. Because of that issue, the MSMEs supervised under their program are introduced to utilize digital payment. In terms of technical guidance and technology, currently, local government programs only focus on how to use the internet, do online marketing, and join the marketplace.

Digital Payments Can Be Inclusive: Case of NTB's Wira Singa Cooperative Partnership with Mandiri E-Cash

Although the use of digital payments is not as wide as in big cities, in general, there is an interesting finding in the NTB. Digital payments identical with the use of the internet and technology require good internet connection, and technology-aware people are usually of the young generation. However, in one cooperative named Wira Singa in Lombok Barat NTB, it is found that digital payment is not necessarily "exclusive" to technologically literate users and those who have access to the internet. The case of Wira Singa Cooperative partnership with Mandiri E-Cash supports this finding. Starting in November 2017, the cooperative partnered with E-Cash, which is a digital payments fintech.

To date, more than 300 villagers, mostly members of Wira Singa majority of whom are farmers and small retailers, created an e-Cash account with their phone number as their ID or account number. Those E-cash users are obliged to deposit Rp10,000 per day; they can do this daily, weekly, or monthly as long as the total deposit, as accumulated, is equal to at least Rp10,000 per day. As mentioned, digital payment generally requires a smartphone and internet connection to transact. In this case, E-cash has a good strategy in achieving financial inclusion of digital payments for those who are usually left behind and cannot enjoy its benefit. E-Cash can provide them digital payments using only a feature phone by accessing USSD with a dial number of *141# and SMS. With such ease, digital payments service can penetrate villages with no or limited internet connectivity and used by those who are not technology-aware, such as senior citizens, farmers, fishers, and other groups of people, as majority of E-Cash respondents only have a feature phone and some are not connected to the internet (Figure 8.5).

The introduction of E-Cash and information dissemination to members of the technical aspect or the benefits of using digital payments are done intensively by officials of Wira Singa. Thus, transactions such as the purchase of agricultural equipment between E-Cash users and the Wira Singa Cooperative can be done using E-Cash, making transactions faster and well recorded. Users can also pay for other goods and services than those provided by the cooperative, such as buying cellular credit, paying for electricity and national health insurance, and others from anywhere and at any time. The price of purchases using E-Cash is also generally cheaper compared to those through agents or modern retail stores, such as Alfamart and Indomaret. Consumers can also save more money from transportation cost because transactions can be done from home. Members of the cooperatives also get some portion of the cooperative's business profit earned through E-Cash member transactions. The more transactions done by members, the greater their share of cooperative profit. Members can also win prizes such as televisions, refrigerators, and others provided by the cooperative to E-Cash users.

E-Cash also positively impacts the Wira Singa Cooperative. First, purchases and sales of the cooperative can be done faster. Second, since all transactions are recorded in the system, their bookkeeping is neatly arranged; the records can be used as reference in checking or reconciling manual bookkeeping. Third, the cooperative obtains additional income considering that, for each transaction made by a member, the cooperative gets Rp1,000 from E-Cash. If about 100 out of 300 people make three transactions per day, the cooperative can profit Rp300,000 a day. Increased earnings of cooperatives from E-Cash transactions can be seen from the various prizes provided by the cooperative for their E-Cash members funded by the cooperative itself. Furthermore, the Rp1,000 per transaction fee earned by the cooperative is not borne by the user, but a fee provided by Mandiri E-Cash. Fourth, incentives in the form of profit share and prizes provided to cooperative members can attract non-cooperative members to join for them to benefit from their own transactions. Given this, the number of Wira Singa Cooperative members has been increasing with time.

However, even though E-Cash can deepen penetration of financial inclusion, particularly on the payment system, and offer many benefits to its users and its agents such as cooperatives, there are some challenges or obstacles that digital payments providers, the Financial Service Authority, Central Bank, Ministry of Communication and Information Technology, and local governments should address. For instance, some users still doubt the security of their funds. To handle such issue, the Wira Singa Cooperative also provides manual records of transactions to users. This, of course, contradicts the efficiency principle of digital payments

since this requires double recording, which is time consuming and inconvenient for both parties. Second, although no transaction fee is charged by E-Cash to its users, the users are charged by the cellular provider an SMS transaction fee of around Rp550 per SMS for the confirmation code (One-Time Password or OTP) via SMS. Some users complain about the cost of the SMS being charged. Third, although no internet connection is required, the transaction needs a good cellular signal. Some users still experience difficulties in making a transaction because of the constraints of the cellular network. In fact, the stability of cellular networks is a main prerequisite for transactions to run smoothly.

Digital Payments' Role in Tourism: Case of Bali's PRC Electronic Wallet Provider, Small Medium Enterprise Sale System

This study also found intriguing facts about Bali like the NTB. Although digital payments are not used by most people in Indonesia, in Bali, which is widely known as a main tourist destination, one digital startup named "Small Medium Enterprise Sale System" (SMESS) has a main business developing point of sales for merchants and provides a platform to receive digital payment from the People's Republic of China (PRC) e-wallets, such as WeChat Pay, QQ Wallet, and others. This fintech works to promote SMEs in Bali by increasing sales to tourists from the PRC by allowing them to pay using their e-wallet. SMESS tries to break the stigma that PRC tourists are unwilling to spend much. They argue that this is not because they are parsimonious; it is because they do not bring large amounts of cash. Instead, their money is mainly stored in their e-wallet since digital payments pay a greater role in the PRC as it is currently the world's most successful country in terms of digital payments and more than 44% of store purchases are paid using the digital payments platform (Chen 2017).

Acceptance of transaction payment using the PRC e-wallet benefits both merchants in Bali and PRC tourists. The addition of such facility will attract more PRC tourists since merchants can receive payment through a familiar digital wallet. The PRC tourists will likely choose digital payments as their provider may offer some benefit if they will use its services. The list of merchants accepting the PRC e-wallet payment is also displayed by each digital payments provider for its users. Therefore, these merchants become more visible to the PRC visitors. Second, these merchants can obtain an additional income at the end of the month equivalent to 1% of total transaction using the PRC e-wallet.

The PRC tourists also gain several advantages in using their e-wallet for payments. First, they do not have to bring a big amount of cash as long as they bring their mobile phone and have internet access. By doing so, they are also safer as losing cash is improbable. Second, they will receive more value compared to cash as they do not have to exchange their renminbi to rupiah. By not using money changer services, the PRC tourists can save money as they are not charged commission. Third, digital payments can make transactions faster and simpler since these can be done within seconds and merchants do not need provide change for payment. Lastly, the PRC tourists may also benefit from cash backs and other offers from providers.

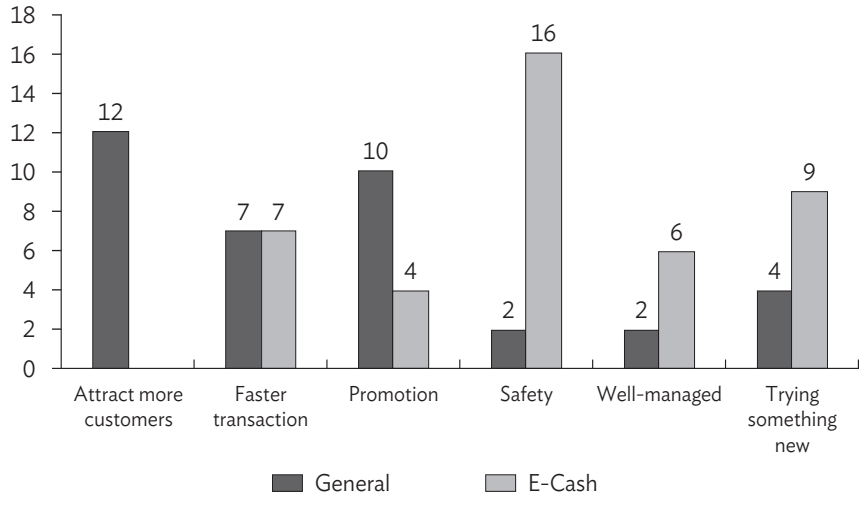
The SMESS has partnered with about 100 merchants mainly in famous tourism spots in Bali such as Kuta, Seminyak, and Nusa Dua. One of their partners is Domba Coffee in Seminyak. This merchant sells premium Balinese coffee to customers from several countries, including the PRC. Since the merchant can accept payment from the PRC e-wallet, its customers from the PRC are quite pleased with the alternative payment besides cash and credit card, the latter of which usually incurs some charges on transactions. Currently, payment using the PRC e-wallet is about 5% of the merchant's total sales.

8.5.2 | Survey Findings

As mentioned, analysis is divided into two categories of respondents instead of by location. These are E-Cash users who are all from the NTB and general fintech users who are other fintech users of T-Cash, OVO, and TokoCash. These general fintech users mostly originate from Bali. Therefore, generally, grouping by fintech providers and location does not differ much.

Both groups have different reasons for joining digital payments providers. The majority of E-Cash users open E-Cash accounts because of money security (16 people), they would like to try something new (9), and for faster transaction (7). Most general fintech users partnered with digital payments providers because they intend to attract more customers (12 people) and for promotion (10). This is because digital payments providers generally offer a lot of promotions, discounts, and cash backs for customers using the digital payments platform. Therefore, customers have more incentives to purchase the product/services of these digital payment providers, which eventually will increase sales.

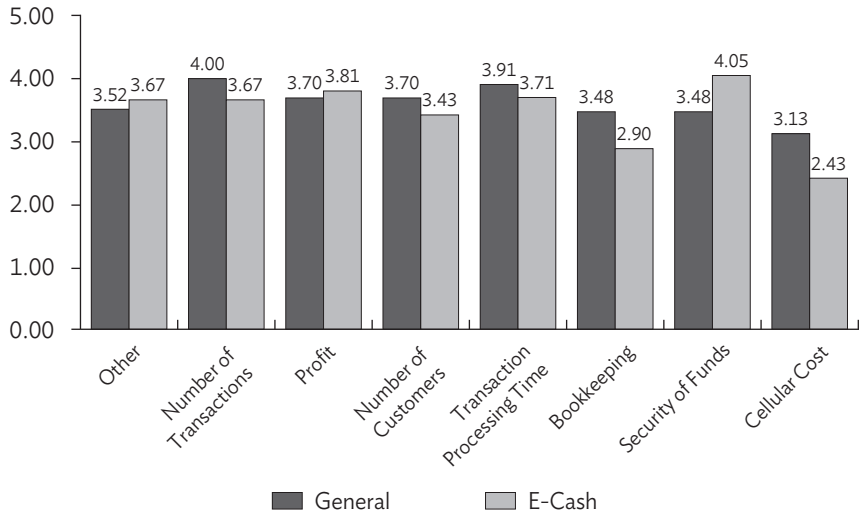
Figure 8.6: Reasons to Join Digital Payments (Number of Answers)



Source: Author's calculation based on survey data.

Furthermore, in this study, one aspect to measure the role of digital payments fintechs in promoting the development of MSMEs is by evaluating the impact of the use of digital payments on the businesses. In terms of general impact, both groups feel that the use of digital payments positively impact their businesses, with a coefficient value of 3.7 for E-Cash users and 3.5 for general fintech users. In addition, the value of 1 indicates very poor impact, 2 for poor impact, 3 for no impact, 4 for good impact, and 5 for very good impact. Therefore, the use of digital payments imply that these have a relatively good impact on their businesses. The reason of, and the largest impact on, the E-Cash group for opening a digital payments account is security of funds (4.05), followed by increase of profit (3.81). General fintech users feel that the biggest impact for them is the increasing number of transactions (4.00) and faster transaction processing time (3.91). One bad impact of digital payments for E-Cash users is the negative impact of cellular cost (2.43) for confirming the OTP. Ironically, E-Cash users, despite the positive impact of digital payments to them, prefer cash payments (Figure 8.8).

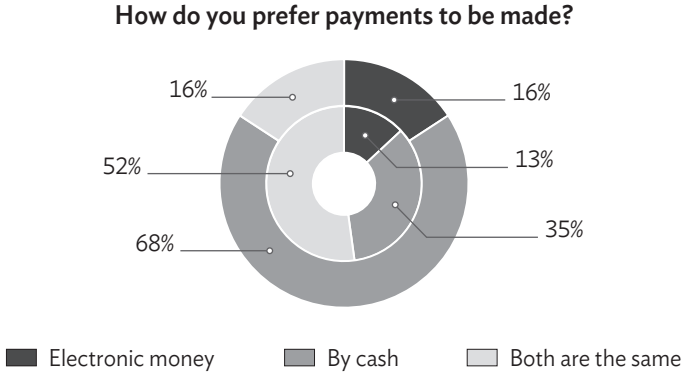
Figure 8.7: Digital Payments Impact to Respondents' Businesses



Note: 1 = Very poor, 2 = Poor, 3 = No impact, 4 = Good, and 5 = Very good.

Source: Author's calculation based on survey data.

Figure 8.8: Payment Preference

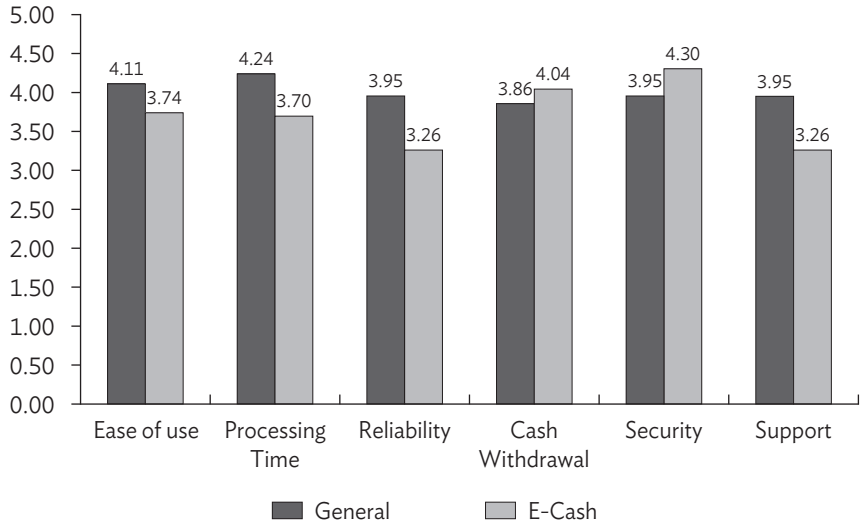


Outer circle = E-Cash, Inner circle = General.

Source: Author's calculation based on survey data.

Regarding respondents' evaluation of the services of digital payments providers, overall, both groups positively scored the providers' services. E-Cash users gave the highest score for services regarding security of fund (4.30), followed by cash withdrawal (4.04), ease of use (3.74), and processing time (3.70). They gave the lowest scores for reliability and support services, both at 3.26. Reliability, which is measured by how often errors during transactions occur, has one of the lowest scores likely because problems in the cellular network cause delayed or unsuccessful transactions. Digital payments may also be unfamiliar to the users and they have not fully mastered how to use the platform. Support services also received the lowest score likely because the party that users are directly involved intensively with are cooperatives officials instead of E-Cash crews. General fintech users scored processing time and ease of use the highest (4.11). By using digital payments, their transactions become faster and easier since only hand phone tapping or QR code scanning is required. Also, no change is needed as the amount transferred from buyers to merchants is exact.

Figure 8.9: Evaluation of Digital Payments Fintech Services

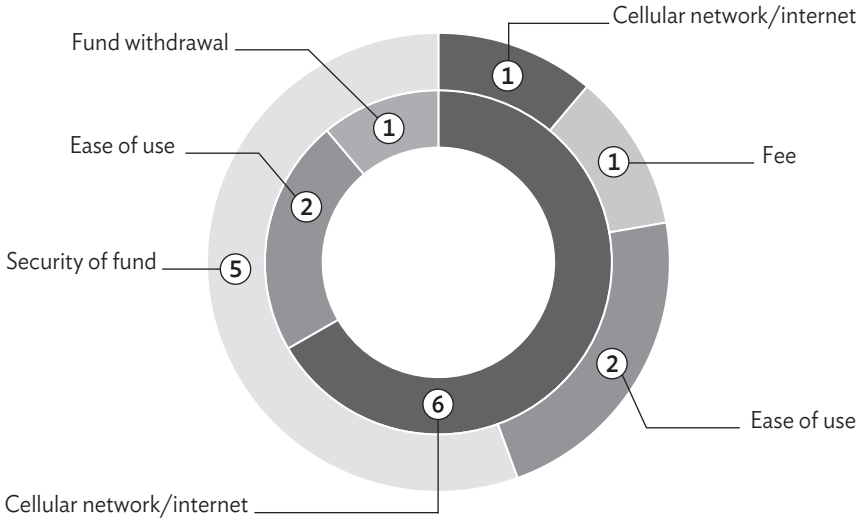


Note: 1 = Very poor, 2 = Poor, 3 = Fair, 4 = Good, and 5 = Excellent.

Source: Author's calculation based on survey data.

In terms of issues in using digital payments, most users do not feel that there are serious issues; only 18 people (39%) said there are. Most general fintech users responded that the main trouble in using digital payments is related to cellular network or internet connection. For E-Cash users, the main issue of digital payments is the security of their stored money.

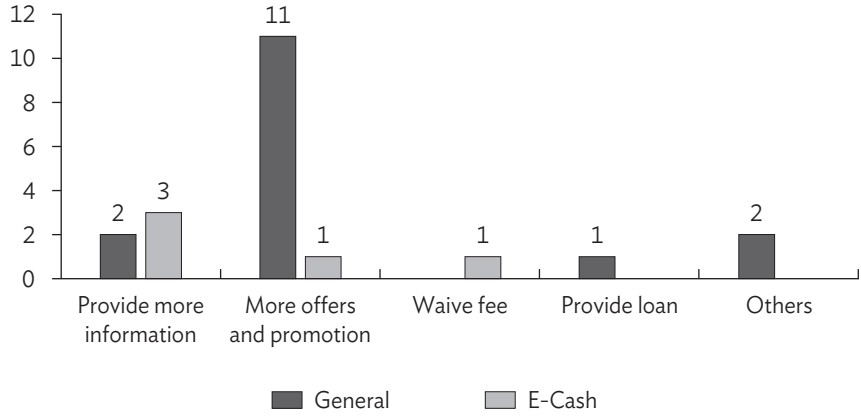
Figure 8.10: Issues of Digital Payments Fintech Services (Number of Answers)



Outer circle = E-Cash, Inner circle = General.
Source: Author's calculation based on survey data.

When asked for suggestions for digital payments fintechs to improve their services, the groups answered differently. Since general fintech users' main purpose in partnering with digital payments companies is to attract more customers, they suggest that digital payments fintechs should provide customers with more offers, promotions, and incentives such as cash backs, discounts, prizes, and other offers. As for E-Cash users, since digital payments are still a relatively new platform for them, they feel that it is better for digital payments fintechs to provide more information about their services, concepts, benefits, consequences, and other aspects.

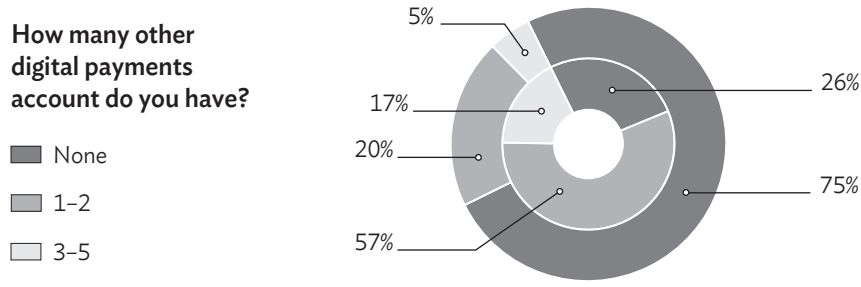
Figure 8.11: Suggestion for Digital Payments Fintech



Source: Author's calculation based on survey data.

The penetration and accessibility of digital payments fintech services to MSMEs were also mapped by measuring the number of digital payments account ownership. The result is again different between the two groups. Most E-Cash users (75%) do not have another digital payment account other than E-Cash. In contrast, majority of general fintech users (74%) have at least one other digital payments account. Thus, digital payments fintech services are implied to have penetrated, and are more accessible in, cities rather than in villages since most merchants of general fintech users are in cities whereas E-Cash users are domiciled in villages.

Figure 8.12: Ownership of Other Digital Payments Account



Outer circle = E-Cash, Inner circle = General.

Source: Author's calculation based on survey data.

8.6 Conclusions

The field observation yields the following conclusions: First, from the case of E-Cash and Wira Singa Cooperative partnership in the NTB, financial technology can be inclusive and benefits those marginalized in terms of geographical and technological capability. Without smartphone, internet access, and technological capability, users can enjoy better payment transactions by using the E-Cash platform. Contrary to common understanding, financial technology does not require high-tech devices such as smartphones and internet access and can be beneficial and used by those who are technologically illiterate.

Second, the adoption of the payment platform that accepts foreign e-wallet as in Bali and the partnership of local merchants with the SMESS benefit both local merchants and tourists from the PRC. Local merchants can attract more PRC tourists, and visitors can find it easier and practical to buy as they can save more money by not having to exchange their renminbi to rupiah.

In addition, results of data analysis from the survey show that, in general, digital payments services positively impact their partners' businesses; in this case, they are mostly MSMEs. Majority of merchants with the highest impact are in the food and beverages business. They are mostly in cities. Fintechs can bring more customers and transactions for these merchants as digital payments provide faster and simpler payment. As for fintechs providing services in villages in partnership with cooperatives, which in this case is E-Cash, users greatly benefit in terms of fund security. The difference in the average number of digital payments ownership between general fintech users and E-Cash users implies that the penetration and accessibility of digital payments services in cities are better than in villages.

Third, although the adoption of digital payments benefits MSMEs, issues and challenges still need to be addressed, such as (i) the doubt of E-Cash users regarding the security of their money, causing cooperatives officials to write down the transactions manually thus resulting in double recording; (ii) majority of E-Cash users feel burdened by the SMS fee charged by cellular operators for payment transactions to be completed; (iii) the instability of internet and cellular network often ended in unsuccessful and delayed transactions; and (iv) the preference of E-Cash users for cash, rather than digital, payments indicates either a technical problem—such as reliability, ease of use, cash withdrawal, etc.—or a non-technical problem—such as the benefits and risks of using digital payments that users have not fully understood and accepted.

8.7 Policy Recommendations

To address the issues mentioned and improve the role of digital payments fintechs in promoting the development of MSMEs, relevant stakeholders—including digital payments fintechs, government, relevant authorities, and others—should formulate several policies. First, the partnership of E-Cash and Wira Singa with local financial institutions that have a better understanding of local people's characteristics and culture has been effectively proven to accelerate financial institutions. Therefore, digital payments fintechs, the Financial Service Authority, the Central Bank, and local governments should promote and encourage this kind of partnership and development. Second, to accelerate penetration of digital payments services and financial inclusion, the government should issue a special mandate for widely used digital payments platform, T-Cash. Considering that T-Cash has the largest number of mobile subscribers in the nation, it is better for T-Cash, owned by Telkomsel, to distribute to beneficiaries of the national social fund—such as Program Keluarga Harapan, an Indonesian conditional cash transfer program—through their digital payments platform.

Third, still to accelerate financial inclusion, local governments are better off partnering with digital payments fintechs to provide technical guidance and training on digital payments as well as to introduce adoption of digital payments to MSMEs under the guidance or authority of local governments. Fourth, to address the issue of SMS charges, it is better for E-Cash to partner with mobile cellular providers for this fee to be waived or at least the amount be reduced. Fifth, still related to the cost, considering that the top-up transaction may involve many banks which consequently impose a fund transfer charge to users, the Central Bank and the government should encourage banks' joint platform, such as the LINK platform joining four largest Indonesian national banks, which is already available at ATMs. This is to accommodate topping up the balance of e-wallets to eliminate or reduce fund transfer charges.

Sixth, because some E-Cash users require more understanding about digital payments and some prefer cash, rather than digital, payments, more intensive information campaigns and education should be done either by digital payments fintech providers, the Central Bank, or the local government particularly for those in the rural areas and are not technologically literate. Seventh, to promote wider use of digital payments services, as suggested by fintech users particularly merchants in urban areas, the Central Bank should create a fully competitive and collaborative environment in digital payments businesses. This will result in more offers and

promotions for customers. This kind of competitive and collaborative environment is successfully proven in China, even making it the most successful country in spreading the use of digital payments (DBS and EY 2016; Yang 2017).

Acknowledgments

The author thanks Agus Eko Nugroho, head of the Economic Research Center (LIPI), for providing constructive inputs, and Yeni Saptia as coordinator of the research team as well as other colleagues of the team for their valuable support and assistance.

References

Adiseshann, A. 2018. Digital payments (e-Payments) are Helping Transform the SME Industry. 2018. *Silicon India Enterprise Services.* https://enterprise-services.siliconindiamagazine.com/viewpoint/cxoinsights/digital-payments-epayments-are-helping-transform-the-sme-industry-nwid-9944.html (accessed 14 April 2018).

APJII. 2017. *Survey Penetrasi Dan Perilaku Pengguna Internet Indonesia 2017*. https://web.kominfo.go.id/sites/default/files/Laporan%20Survei%20APJII_2017_v1.3.pdf (accessed 25 October 2018).

Bank Indonesia. 2013. Sistem Pembayaran. https://www.bi.go.id/id/sistem-pembayaran/Contents/Default.aspx (accessed 15 April 2018).

Boston Consulting Group and Google. 2016. Digital Payments 2020: The Making of A $500 Billion Ecosystem in India. http://image-src.bcg.com/BCG_COM/BCG-Google Digital Payments 2020-July 2016_tcm21-39245.pdf (accessed 17 April 2018).

Chen, T. 2017. China Mobile Payment Report 2017. WalktheChat. 2017. https://walkthechat.com/china-mobile-payment-report-2017/ (accessed 15 May 2018).

ConnectAmericas. 2015. Electronic Payment Systems Boost SME Internationalization. https://connectamericas.com/content/electronic-payment-systems-boost-sme-internationalization (accessed 26 June 2018).

DBS and EY. 2016. The Rise of Fintech in China: Redefining Financial Services. https://www.ey.com/Publication/vwLUAssets/ey-the-rise-of-fintech-in-china/%24FILE/ey-the-rise-of-fintech-in-china.pdf (accessed 30 June 2018).

Deloitte. 2018. SME Digital payments: New Opportunities to Optimise. https://www2.deloitte.com/content/dam/Deloitte/au/Documents/financial-services/deloitte-au-fs-sme-digital-payments-270218.pdf (accessed 7 May 2018).

Dorfleitner, G., H. Lars, S. Matthias, and W. Martina. 2017. *FinTech in Germany*. Springer Nature. https://doi.org/10.1007/978-3-319-54666-7.

Ferdian, A. 2017. Transaksi Ritel Uang Tunai, Indonesia Tertinggi Di Asean. *RMOL Jabar*. 20 October. http://rmoljabar.com/read/2017/10/20/57789/Transaksi-Ritel-Uang-Tunai,-Indonesia-Tertinggi-di-Asean- (accessed 7 May 2018).

Indonesia Fintech Association and Daily Social Indonesia. 2016. Indonesia Fintech Report 2016. https://kupdf.com/downloadFile/59aac284dc0d601645568edc?preview=1 (accessed 7 May 2018).

Pratama, A. 2018. 3 *Tren Penting Dalam Perkembangan Layanan Pembayaran Mobile Di Indonesia*. *Tech In Asia.* 5 March. https://id.techinasia.com/laporan-mdi-ventures-pembayaran-mobile (accessed 2 May 2018).

Remon, S. 2016. *Tantangan Transaksi Nontunai Di Indonesia*. *Kontan*. http://analisis.kontan.co.id/news/tantangan-transaksi-nontunai-di-indonesia (accessed 7 May 2018).

Wahlster, W. 2012. From Industry 1.0 to Industry 4.0: Towards the 4th Industrial Revolution. In *Forum Business Meets Research*.

Yang, Q. 2017. Third-Party Online Payment Solutions in China Case Study: Alipay. Lahti University of Applied Science. https://www.theseus.fi/bitstream/handle/10024/130401/Yang_Qian.pdf?sequence=2 (accessed 11 June 2018).

CHAPTER 9

A Proposal on the "*i* Bank Index": A Measure of Banks' Ability to Nurture Client Businesses*

KIYOTSUGU YOSHIHARA
Kyoto University

9.1 Research Objectives

This chapter aims to gauge a bank's ability to develop and nurture its client businesses. What exactly has to be done from the lender's viewpoint to perform growth-inducing financing? Can equal amounts of capital have different levels of impact on businesses?

According to Japan's Small and Medium Enterprise Agency's 2005 Version of Establishment and Enterprise Census, the number of companies in Japan reached a peak in 1986 at 5,351,000 companies and has since followed a downward path. If the number of companies indicates Japan's economic health, the bell-curve peak is past, and the state of the economy has since started to follow a downward trend from some point.

The main issue to investigate in this chapter is whether there exists a nurturing effect on businesses attributable to banks' business activities (lending and other activities attached to lending).

The Ministry of Finance of Japan has made clear its stance that banks are expected to not only function as providers of credit but also to provide business consulting through long-term relationships with businesses to help with continuous improvement and foster business expansion. Recent financial supervision policies have embedded this as a basic policy. At the core of this policy is the idea that the meaning of banks' existence lies in its being able to contribute to the development of client firms.

* A patent has been filed for the new *i* Bank index bank evaluating model. Inventor: Kiyotsugu Yoshihara. Patent administrator: Kyoto University.

From this line of thought, it is therefore natural to "evaluate" banks, and for banks to self-evaluate, with reference to the level of their contribution to client businesses. To this end, to make use of an index that aligns with these objectives—i.e., one that reflects the level of banks' contribution—is preferable.

The viewpoint that banks' meaning of existence is the development of client businesses does not consider the relationship between banks and client businesses as a simple risk-and-return relationship. The simple viewpoint of a risk-and-return relationship assumes that no matter who provides the credit, capital is just capital. On the other hand, the viewpoint that banks also function to nurture businesses and provide consultation in addition to providing credit holds that businesses do grow exactly because they received credit and consultation from a certain bank.

In other words, a company's long-term growth prospects are affected by which bank gives the company credit. Banks are expected to raise the growth potential of client firms not only by providing credit but also by playing a part in establishing client firms' governance and assisting operations or risk management. However, no major evaluating index presently reflects this idea.

The relationship between banks and client firms has reflected a cycle of give and take. If this harmonious give-and-take cycle is in place, it is a driving force for economic development. It is generally accepted that this cycle does not impede or go against economic development. It is based on the idea that banks' services will help nurture client firms and promote economic development at the same time. In the short term, however, fees and interest payments that banks receive from client firms may give rise to incentives that go against long-term missions for banks and, hence, produce a trade-off relationship. How we find a solution to this trade-off relationship will become an important issue.

Banks often have clear-cut targets to meet. The clearer the target, the easier the assessment process. However, when it comes to establishing proof as to whether the nature of banks' targets allows banks to work in favor of promoting growth and development for client companies (as opposed to short-term profits), things are not often straightforward.

9.2 Explanation of the New Index

The idea that companies' performance is represented not only by their economic value (as measured by financial indicators) but also by their value to society is gaining more and more recognition. Environmental, social, and governance investments serve as one example.

On exactly what to base judgments as to whether a company's performance has improved is something that remains an issue. Obviously, possible indicators are not limited only to comparisons with the company's past performance or with other companies in the same industry.

The author believes that it is necessary to recognize the cause-and-effect relationship between banks' activities and client companies' performance—banks' supportive activities being the cause and improvements in client companies' finances being the effect—and evaluate banks according to their contributions to client companies.

This chapter will, therefore, model banks' evaluating index not on banks' financials but on client companies' financials instead. The author has in mind a simple set of principles, short enough to fit on a piece of paper, on which to base the banks' new evaluating index.

As of 2016, Japan's Ministry of Finance has implemented a supervision policy on banks that especially focuses on banks' financial soundness with respect to the following six indicators:

(i) Equity capital (as an early corrective measure)
(ii) Aggregate risk management
(iii) Profitability
(iv) Credit risk
(v) Market risk
(vi) Liquidity risk (based on the Basel Committee on Banking Supervision's international standards)

Profitability is a most important indicator, as it is vital to long-term business sustainability. Profitability takes reference to indicators of banks' efficiency such as operating profits, ordinary profits, net profits, return on assets, and return on equity.

However, these six indicators are not directly related to the development of client firms but instead are mere indicators of banks' financial shape. There is a trade-off relationship between banks' short-term performance and client firms' long-term growth. For example, a bank may manipulate the level of interest it charges with respect to client firms' risk profile to prop up its short-term operating results. For the client firm, such action will drain away part of its long-term growth capital. Banks' financial data will only reflect the short-term effect from such decisions without recognizing the trade-off relationship in the bigger picture.

A company's financial data is a huge collection of numerous and various causes and effects. From financial data alone, it is hard to differentiate banks that have grown together with client companies from those that are highly profitable at the sacrifice of client companies. Current major evaluating indices for banks do not directly reflect the idea that banks exist to nurture and develop client companies. This is the central issue of this chapter.

In modeling the situation, this chapter assumes the following regarding banks' decision making. Banks that see their meaning of existence as the long-term development of client firms will lend to clients at an appropriate interest rate in consideration of each individual risk profile and growth prospect. If the lending decision turns out to be correct, the bank also wins. As mentioned before, banks will raise client firms' growth prospects and reduce client firm risk not only by making the right decision in the first place but also by providing client firms with advice on management and operation. This, in turn, will benefit the bank's performance in the long run.

Viewed in this light, the performance of client firms can be positioned as a leading indicator for banks' performance. The approach of this chapter is to return to the basics and design an evaluating index for banks by focusing on the cause-and-effect relationships in the management process (decision making, action, and results) instead of just mechanically breaking down financial results. Client firms' performance as a leading indicator aligns well with banks' meaning of existence (growth and development of client firms). To design a process-oriented evaluating index rather than one that focuses purely on results, this chapter will base the new evaluating index on client firms' financials instead of banks' financials. Based on this idea, we shall move on with modeling the new index based on client firms' financial data. The new indicator will highly evaluate banks whose client firms have made good progress.

The problem now turns to exactly what it is that we can base our judgment of the trends in client firms' performance. Are banks positively affecting the financials of client firms? Are they contributing to the development of client firms? Unfortunately, the evaluating indices at present cannot reach these conclusions.

9.3 What Exactly Does the New Index Measure?

There are close interactions between financing and the development of firms. To date there has been little research on these interactions from both a qualitative (business operation support) and a quantitative (financial support) point of view. Based on this assumption, the aim is to focus on determining the ability of banks to nurture companies.

Even though the two are tightly correlated, the fact that a bank financed a successful firm does not directly translate to the conclusion that the bank can nurture companies. It may be that the client was originally a winning firm and had huge potential for growth and development from the start.

Figure 9.1 represents the idea that banks' competence lies in the ability to pick winning firms. Here, the bank finds Company X whose track record and potential for growth and development have always been excellent. The bank profits from its being able to identify such companies. On the other hand, if the bank fails in the selection process and picks a losing firm, Company Y, with little potential for growth and development, will lose part of its assets and its profits.

Figure 9.1: Ability-to-Pick Paradigm

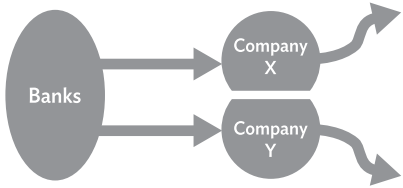


Figure 9.2: Ability-to-Nurture Paradigm

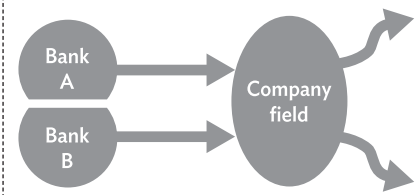


Figure 9.2 represents the idea that, depending on the competence of a firm's bank, the firm may either improve its performance or produce worse results. Here, Bank A is able to nurture companies. It lends money to a company that seems to have little potential at first glance but nurtures the company and brings it to success. In contrast, Bank B does not have the ability to nurture companies. Bank B lends money just like Bank A but fails to lead client companies to higher levels of success than they exhibited at the start.

Both cases between Company X and its bank and between Bank A and its client firm had good outcomes. However, the nature of the two cases is different. In the former, the bank was able to pick winning companies from the start. In the latter, the bank worked with its client firm, which initially was not in good shape and contributed to improving its finances.

In both cases, banks' undertakings seem to have been successful. Both the bank and the firm grew. Conventional evaluating indices for banks would evaluate both cases equally, but the new evaluating index will evaluate the latter case more highly. With conventional evaluating indicators firmly in place, the author believes bank regulators may not have their focus right.

In summary, there are two kinds of banks: one with the ability to pick winners and one with the ability to nurture businesses. Both types perform financing activities, but the contents and the effects of their activities are totally different.

One assumption is made here. To discern the quality of a bank, the average profit margin on all client firms doing business with the bank is compared against Japan's national average. The bigger the positive divergence, the higher the quality of the bank.

Tables 9.2 to 9.3 outline the steps for examining a bank's quality.

Table 9.1: Simple Deviation from the National Average

Step
High score ... Bank is able to pick winning firms and deals only with winning firms as a result.
Low score ... Bank is able to pick winning firms and ends up with bad businesses.

It is hard to measure a company's ability to nurture firms with step 1 alone. There are limitations to yearly comparison of operation results.

Table 9.2: Comparison of Banks' Picking Ability over a Long Time Frame

Step
Constantly able to maintain a significant positive divergence from the national average in the long term ... Has picking ability
Constantly remaining significantly below the national average in the long term ... No picking ability

At this point, it is possible to judge a bank's picking ability but not yet the ability to nurture banks.

Table 9.3: Comparison of a Bank's Nurturing Ability over a Long Time Frame

Step
New index constantly improves over a specified period ... Has nurturing ability
New index constantly worsens over a specified period ... No nurturing ability

As Table 9.3 points out, even if a firm's financials are below the national average at the start of transactions with its bank, the bank can be judged to have nurturing abilities if the firm's financials improve over time as it transacts with the bank.

Putting aside the issue of exactly how banks nurture client companies, it has become possible to measure banks' nurturing abilities. Based on the new index, marked improvements can be seen in the financials of companies that do business with banks that have nurturing abilities even though those companies start out below the national average. The new index will highly evaluate banks whose client companies can positively shift their financials at a comparatively large degree even though their financials may remain under the national average at the end of the observation period. These are banks with nurturing abilities.

In summary, given one specific indicator of management (e.g., return on equity, return on assets), the new evaluating index is defined as the difference between the client firms' average regarding the specific indicator of management and the national average on the same indicator of management. This new index measures both the position of a bank's client firms relative to the national average and the direction in which client firms are heading while doing business with the particular bank.

9.4 Modeling the New Index[1]

Capital is lent from banks and used in firms. Part of the proceeds then return to banks in the form of interest payments, which become the bank's sales. This has been the starting point for the idea behind conventional evaluating indices. Certainly, this chapter does not aim to negate the idea that banks operate for profit. Instead, this chapter focuses on client firms because, as explained, a strong relationship exists between client firms' operating results and the bank's activities.

For clarity, the new index can be put in mathematical expression as follows.

P represents one predetermined corporate indicator of management; i and j are numbered tags to each client company. Further, n represents the total number of client companies, m the national total number of companies, and t the fiscal year. $P(i, t)$ and $P(j, t)$ represent firm i and firm j's value on the predetermined corporate indicator of management in fiscal year t. $IN(P, t)$ represents the evaluating index for fiscal year t with regard to the predetermined management index P.

$$IN(P,t)=\frac{1}{n}\sum_{i=1}^{n}P(i,t)-\frac{1}{m}\sum_{j=1}^{m}P(j,t) \qquad \text{Equation 9.1}$$

The first term on the right-hand side of Equation 9.1 represents the average for all client firms on a specific indicator of management.

$$\frac{1}{n}\sum_{i=1}^{n}P(i,t)$$

The second term on the right-hand side represents the national average.

$$\frac{1}{m}\sum_{j=1}^{m}P(j,t)$$

Equation 9.1 compares the average taken on all transaction partners for a bank regarding a specific indicator of management against the national average. This indicates the degree of deviation from the national average. On the other hand, the new index will have a feature that bases its judgment on the degree of improvement in client firms' financials.

[1] The author has named this the Intelligence Bank Index (*i* Bank index).

In other words, Equation 9.1 is simply Figure 9.1 expressed in equation terms. This is the model design whereby it is easy to judge the ability to pick winning firms but not the ability to nurture companies.

To provide an example of usage for such an evaluating index, consider the case when the current ratio is chosen as the management indicator P. Banks that score positively are banks that only do business with companies in sound financial health. On the other hand, banks scoring negatively are ones whose transaction partners are not in very stable financial health. However, this will not provide any check on whether the bank has supported its client firms in any way.

Equation 9.2 calculates the rate of change in $IN(P, t)$. Using this, the banks' ability to lead client firms toward higher levels of growth and development can be evaluated.

$$\Delta IN(P,t1,t2) = \frac{IN(P,t2) - IN(P,t1)}{IN(P,t1)} \qquad \text{Equation 9.2}$$

$IN(P, t2)$ represents the evaluation index as of fiscal year $t2$ with regard to management indicator P. $IN(P, t1)$ represents the evaluation index as of fiscal year $t1$ with regard to management indicator P. Finally, $\triangle IN(P, t1, t2)$ represents the rate of change in the evaluation index from fiscal year $t1$ to fiscal year $t2$.

The higher the rate of change in the evaluation index, the higher the bank's ability to contribute to client firms' financials. In other words, the bank can be said to have nurturing abilities. This provides a quantitative judgment on the degree of banks' capability to nurture and to contribute to the development and growth of companies it does business with.

In practice, we can benchmark average results calculated from a bank's client firms against data provided by third-party institutions.[2] This could be data publicly disclosed by private or public institutions.

The issue of which indicator of management P to adopt depends on several factors, such as the bank's market, its customer base, whether the bank mainly operates nationally or regionally, and the major industry segment in its lending portfolio.

[2] Indicators of management relevant to firms' growth and development may include growth (net income growth rate), profitability (recurring profit margin), and financial soundness (debt—equity ratio or capital asset ratio). If the appropriateness of such indicators can be guaranteed, the author thinks there is no need to stick to any particular indicator.

Banks should be allowed to pick which index to adopt by themselves if such decisions can be deemed appropriate. This applies especially to Japan's credit unions—banking cooperatives that serve a particular region or a specific industry.

What is important is that even though Equation 9.1 yields a negative deviation from the national average, the bank can still be highly evaluated if Equation 9.2 yields a positive rate of change. This will be an indicator of the bank's contribution to client businesses—something the bank can be proud of.

9.5 Summary: Uses of the New Evaluating Indicator

First, it is necessary to recognize the cause-and-effect relationship between activities of banks and the development of client firms. From there, the relationship is modeled and explained with easily recognizable, quantifiable amounts instead of stopping short at focusing on only the bank's part. Indicators that are not clearly quantifiable, such as customer satisfaction or increased usage frequency, should not be used.

Also, evaluation of banks should not stop short at mere comparison with past performance or comparison with rival companies. The author believes this index has a meaningful purpose and should be used along with conventional indicators (ones that focus only on the bank's part). The index is a simple tool that can be used proactively. The problem with conventional indicators is that one can only indirectly grasp banks' contribution to client firms.

Banks and the development of firms are highly interrelated. Measuring the effects that banks have on the development of firms and the use of those measuring indicators might have always been unclear. Making those issues clear has been the central aim of this chapter.

Finally, the author expects the new banks' evaluating index to perform the following roles:

(i) Act as a monitoring tool when ensuring a bank's quality, i.e., its ability to nurture client firms.
(ii) Perform impartial evaluation on various types of banks, be it big regional banks or small subregional banks.
(iii) Detect abnormalities in banks' behavior or a possible sign of a bubble when deviation on the new index becomes either strangely too high or too low.

Although this chapter is mainly focused on Japan's case, the author has ambitious hopes to expand the research to cover the case for other countries, particularly the case for countries in lower stages of development, as the author believes the new evaluating index will also work well in such contexts.

References

Ministry of Finance, Japan. 2009.「企業者等に対する金融の円滑化を図るための臨時措置に関する法律に基づく金融監督に関する指針 」(Financial Supervision Policy Based on Laws Related to Temporary Measures for Facilitation of Entrepreneurial Finance). December.

———. 2016a.「中小・金融機関向けの総合的な監督指針」(General Supervision Policy for Small and Medium size Financial Institutions). June.

———. 2016b.「金融機関に期待される役割」(Roles Expected of Financial Institutions). May.

Index

Boxes, figures, notes, and tables are indicated by b, f, n, and t following page numbers.

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

Fintech for Asian SMEs

SMEs play a vital role in the Asian economy and comprise about 70% of the workforce and GDP in the region. To enhance productivity and ensure sustainable growth in Asia, it is vital to provide smooth financing to SMEs. Traditionally, commercial banks in Asia have regarded loans to SMEs as too risky relative to high transaction costs. However, new technologies including distributed ledger technology, cloud computing, and artificial intelligence are becoming a means of offering faster and more convenient and cost-effective financial services. The digital innovation could help SMEs to have easy access to finance in various routes.

This book identifies and develops ideas on how to utilize new technologies to promote SME finance. It could encourage financial institutions and investors to develop new credit risk analysis tools, increase credit supply, and encourage sustainable growth for SME sectors. In addition, the book explores the ways policy makers and market participants could maximize the benefits while mitigating potential risks arising from the new digital era. The messages are important for the public and private sectors in Asia.

About the Asian Development Bank Institute

ADB Institute, located in Tokyo, is the think tank of the Asian Development Bank, an international financial institution. ADBI aims to be an innovative center of excellence for the creation of rigorous, evidence-based knowledge that can be implemented as new actionable policies by developing and emerging economies, so as to contribute to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific. It also contributes to ADB's overall mission and operational priorities in line with ADB's Strategy 2030. This vision will lead ADBI to continue to be a globally recognized think tank.

Naoko Nemoto is a financial economist at the Asian Development Bank Institute and professor at the Graduate School of Business and Finance, Waseda University, Tokyo, Japan.

Naoyuki Yoshino is the dean of the Asian Development Bank Institute and emeritus professor at the Department of Economics, Keio University, Tokyo, Japan.

ADBIPress

ASIAN DEVELOPMENT BANK INSTITUTE
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo, 100-6008 Japan
Tel +81 3 3593 5500
www.adbi.org