



# DISRUPTIVE TECHNOLOGY IN INDONESIA'S BANKING SECTOR





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## Abstract

This paper examines Indonesia's banking sector, particularly the development of financial technology (fintech) over recent years. The study conducts a firm-level survey to observe banks' current level of technological adoption and to capture banks' perceptions toward fintech development. We also perform secondary data analysis using Indonesian commercial banks' data from 2005 to 2017 to see whether fintech development has impacted banks' efficiency. The survey findings reveal banks are still at an early stage of technological adoption, with high usage of internet and mobile banking platforms. Indonesian banks are aware of and responsive to fintech development, but do not perceive it as a threat or a new competitor. In addition, our regression analysis shows factors such as market competition and level of risk aversion have significant impacts on banks' efficiency, such that a lack of competition may result in higher inefficiency. This paper suggests encouraging more competition and technology adoption within the banking sector, to increase efficiency as well as coverage, through fostering fintech development in Indonesia.



# Disruptive Technology in Indonesia's Banking Sector

## 1 Introduction

The title of this paper suggests a potential for technology-driven upheaval or disruption in Indonesia's banking sector in the coming years. There are many possible outcomes of such a process. It could lead to a much diminished role of the banking sector in the provision of financial services. Currently, banks play a dominant role in the country's financial industry. Under the disruption scenario, nonbank technology-based financial companies (hereafter, fintech companies) could capture a significant fraction of the services that banks have hitherto provided. Alternatively, banks may be able to retain their dominant position by going digital and in the process transforming the industry from product-centric to customer-centric.


Banks are one of the oldest, if not the oldest, forms of financial institution. It seems inevitable, therefore, that their future might be called into question from time to time. Recently, triggered by two developments, people posed such doubts again. The first development was the 2007-2008 global financial crisis. Many (e.g. Krugman, 2007) have criticized the financial industry, and the banking industry in particular, for its role in the crisis. In particular, people have questioned the soundness of the industry's decision to introduce financial products such as collateralized debt obligation (CDO) that have been blamed for being among the main culprits of the crisis. Many dubbed the creation of such financial innovations as 'destructive creation' rather than 'creative destruction' (Levine, 2015). Suffice to say that the crisis significantly eroded people's trust in the financial system in general.

The second development—more relevant for this study—is the emergence of what is now commonly called fintech. Although technological innovations are not alien to the banking industry, the current development is, in some ways, quite distinct. In the past, innovations were often initiated in one bank before spreading throughout the banking industry. The introduction of automated teller machines (ATMs) in 1967 by Barclays Bank is a case in point.<sup>1</sup> At present, many of the recent financial technologies were introduced by nonbank startup companies to deliver financial services, in direct competition with banks. Those innovations are altering the delivery modes of financial services. Another distinct feature of the recent developments is that many innovations have occurred in a relatively short period and are still continuing in earnest. Many banks are still delivering their services the old way, as every innovation entails a certain cost. In addition, some banks may not know in which technology or technologies they should be investing first.

The question, therefore, is whether this time is different. There is no doubt that this time around, banks will face more serious competition from fintech companies. This paper argues that it is too early to provide a definitive answer to the above question. It depends, among

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<sup>1</sup> Arner et al. (2015) argue that the introduction of ATMs marked the beginning of the evolution of today's modern fintech.



other things, on how the banking industry responds to competition from the fintech companies. It is also quite likely that the results will vary from one country to another.

Hence, the main objective of this study is to investigate Indonesia's banking industry responses to recent fintech innovations as well as the emerging competition from fintech companies.

The analysis is based on a survey of the banking industry conducted especially for this purpose. In addition, to complement the perception survey, we also conducted a regression analysis using the banking sector's secondary data, aimed at capturing the impact of fintech development on Indonesia's banking sector performance, as well as in-depth interviews with fintech companies in the country.

## **2 Framing the Analysis: An Overview of Recent Financial Developments in Indonesia**

In this study, disruptive technology in the banking sector is assumed to be a result of the pervasive use of fintech to deliver various financial services. As a working definition of fintech, this study adopts that of the Financial Stability Board (FSB), which defines it as “technology-enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services” (FSB 2017, p. 7).

There are two channels through which disruptions in the banking sector can occur. Banks in general may adopt and apply digital technologies to deliver a wide range of financial services. Under such circumstances, the banking industry may use new financial technologies as leverage to overhaul existing business practices so as to retain or even enlarge its customer base by way of improving financial service delivery. Such a change may mean a much leaner banking industry with fewer employees.

Alternatively, the disruptions may occur as a result of increasing competition from fintech companies that utilize technology to deliver various financial services that have hitherto been primarily provided by traditional banks. Under this scenario, the role of the banking sector as the main provider of financial services may be significantly diminished from what it is today. These two channels are not mutually exclusive.

As discussed below, fintech development in Indonesia is still at an early stage. As in other countries, fintech innovations take place within the banking industry as well as outside it, especially among financial startup companies.

It is quite likely that banks in Indonesia will only adopt financial technologies gradually. As noted, such a move may entail high fixed costs, which some banks might be unwilling to assume, especially for technologies of uncertain merit. Moreover, banks may have to prioritize their investment spending over a number of competing financial technologies.

## 2.1 Bird's-Eye View of Indonesian Banking Industry

The Indonesian banking industry consists of more than 1,700 banks, of which 115 are commercial banks and 1,630 are rural banks (Financial Services Authority [OJK], 2018). The banking sector is dominated by the four largest banks—state-owned Bank Mandiri, Bank Rakyat Indonesia (BRI) and Bank Negara Indonesia (BNI), and private bank Bank Central Asia (BCA)—which together represent more than 40% of total lending assets in Indonesia. The other larger and smaller commercial banks account for almost half of total lending assets, while the remainder is distributed among rural banks, multifinance companies, and newcomers such as fintech companies.

The Indonesian banking industry has experienced steady growth and has continued to show improvements in the quality of assets, credit worthiness, and operating environment. A large consumer base, low market penetration, and stable economic growth continue to be the key drivers of growth, making Indonesia an attractive market for foreign financial institutions in Southeast Asia.

**Table 1. Summary of Banking Sector Indicators in Indonesia, 2016-2018**

Indicator	2016	2017			2018		%YoY
	Dec	Mar	June	Dec	Mar	June	June-18
Total Asset (IDR trillion)	6,729.8	6,929.6	6,754.4	7,387.6	7,429.9	7,650.5	8.9%
Deposits (IDR trillion)	4,836.8	4,916.7	4,821.2	5,289.2	5,293.1	5,398.8	7.0%
- Demand Deposits	1,124.2	1,146.0	1,165.8	1,233.3	1,234.4	1,311.6	9.9%
- Saving Accounts	1,551.8	1,489.6	1,489.9	1,701.2	1,643.0	1,717.3	10.2%
- Time Deposit	2,160.7	2,281.1	2,165.5	2,354.7	2,415.7	2,370.0	3.2%
Loans (IDR trillion)	4,377.2	4,370.0	4,305.8	4,738.0	4,743.2	4,974.1	11.1%
Capital Adequacy Ratio (%)	22.7	22.7	22.7	23.2	22.7	22.0	(83.0)
Return on Assets (%)	2.2	2.5	2.5	2.4	2.5	2.4	(5.0)
Net Interest Margin (%)	5.5	5.2	5.4	5.2	5.1	5.1	(25.0)
Ops. Expense/Ops. Income (%)	82.9	80.7	79.0	78.6	78.8	79.5	46
Loan to Deposit Ratio (%)	90.5	88.9	89.3	90.0	90.2	92.8	345

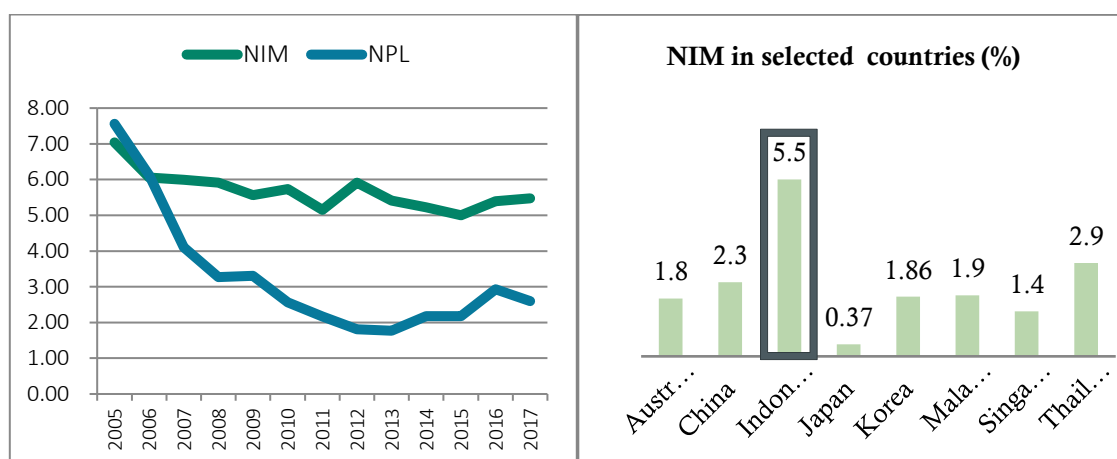
YoY = year on year

Source: Financial Services Authority

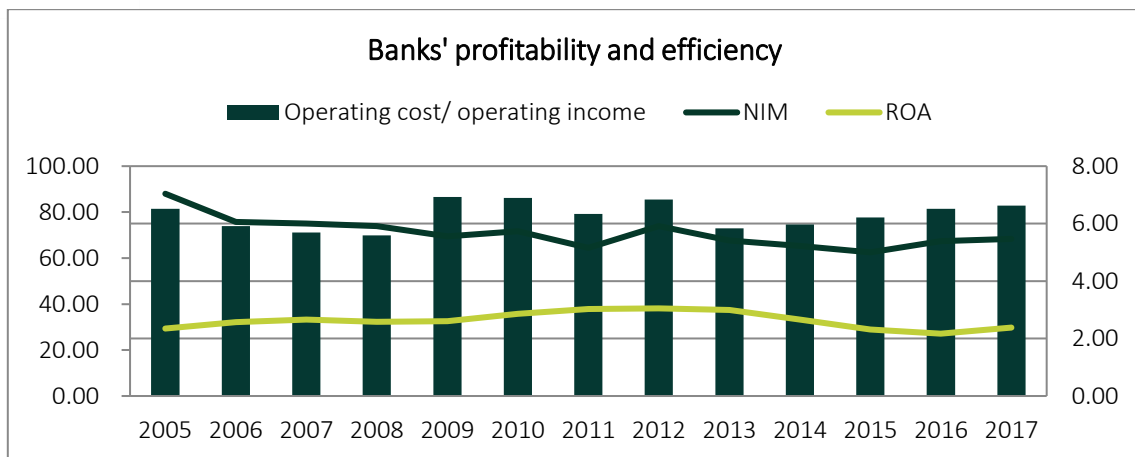
The recent global financial crisis has somewhat adversely affected Indonesian banking industry growth. Banks have become more cautious in disbursing loans, thus decelerating loan growth across industries. The crisis notwithstanding, banks' credit quality nevertheless improved steadily between 2005 and 2013, as reflected in the downward trend of the non-performing loan (NPL) rate during that period, before it began to deteriorate. Meanwhile, banks' net interest margin (NIM) slightly decreased, suggesting some improvement in banks' efficiency during the period under consideration.<sup>2</sup> Despite the noticeable improvement in efficiency, however, the country's banking industry remains among the least efficient in Asia and the Pacific (Figure 1).

Notwithstanding the abovementioned challenges, such as seemingly deteriorating credit risks in the last few years and interest margin pressure, improvements in banks' performances—particularly in loan growth—are expected to continue (PricewaterhouseCoopers (PwC), 2018).

**Figure 1: Indonesia's Bank Indicators, 2005–2018**



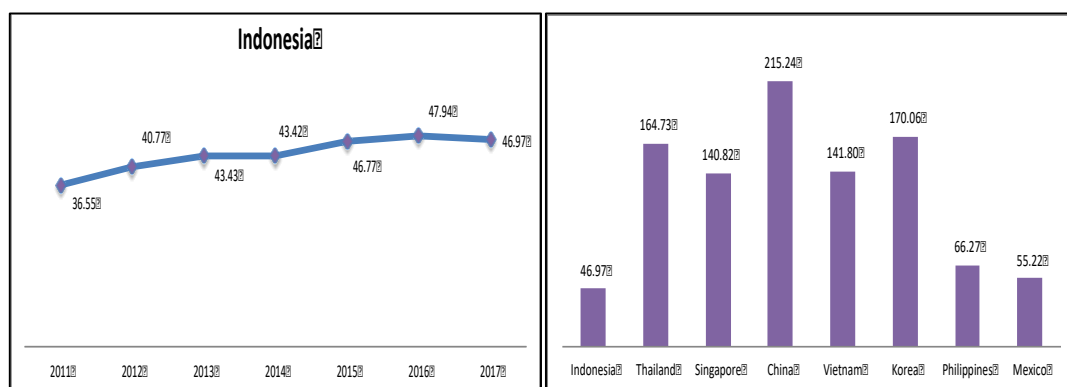
<sup>2</sup> NIM is commonly used as an indicator of the banking sector's efficiency. The smaller the margin, the more efficient the banking sector under consideration is.



**NIM = net interest margin, NPL = non-performing loans, ROA = return on asset**  
**Source: Infobank**

Banking penetration in Indonesia has increased gradually over the past few years. As of 2017, the credit to gross domestic product (GDP) ratio accounted for approximately 47%, up from less than 37% in 2011. However, this number is still low compared to other emerging markets such as Korea and Thailand, where the number is around 160%-170% (Figure 2). According to the OJK (2018), the largest proportion of loan distribution is concentrated in Java, representing about 78% of total loan distribution. The low penetration rate is partly due to Indonesia's geographical barriers, which hinder financial service providers in reaching customers in other regions. Note that Java accounts for around 57% of the country's total population and contributes around 58% to the national economy.

**Figure 2: Domestic Credit Provided by Financial Sector (% of GDP) in Selected Countries**



**GDP = gross domestic product**  
**Source: World Bank**

Another possible reason is that less than half of the adult population in Indonesia has a bank account, and these are mostly held by members of higher-income groups; there is a 20% gap

of account ownership between higher and lower-income groups (World Bank, 2017). This is despite a noticeable development in this respect in recent years, as shown by indicators of access and usage.

Prior to 2014, there was a rapid growth in access to the financial sector/commercial banks, such as through the number of ATMs and bank branch offices. Common average growth rates (CAGRs) of access to ATMs and bank branches were higher than the growth of the usage indicator (see tables 2 and 3). CAGRs for financial access ranged between approximately 15%-21% in 2004-2013 while in the same period, CAGRs for financial usage were roughly 6%. In the subsequent period of 2014-2017, the growth rate of financial access was down to a single-digit rate, while at the same time, the opening of savings/deposit accounts in commercial banks increased significantly, by approximately 20%.

**Table 2: Indonesia's Access Indicator for Financial Inclusion, 2004-2017**

FI Access Indicators	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	CAGR 04-13	CAGR 14-17
ATMs per 1,000 km <sup>2</sup>	7.39	8.16	9.36	10.41	12.10	13.22	12.39	15.91	35.15	42.03	50.05	54.81	57.09	58.87	21.31%	5.56%
ATMs per 100,000 adults	8.56	9.33	10.50	11.47	13.11	14.11	13.03	16.45	35.78	42.15	49.45	53.31	54.75	55.61	19.37%	3.99%
Branches of commercial banks per 1,000 km <sup>2</sup>	4.46	4.62	5.10	5.42	6.07	7.15	7.71	14.22	16.60	17.65	18.14	18.25	18.13	17.89	16.52%	-0.47%
Branches of commercial banks per 100,000 adults	5.17	5.28	5.72	5.97	6.58	7.63	8.10	14.71	16.90	17.70	17.92	17.75	17.39	16.89	14.66%	-1.94%

**FI = financial inclusion, CAGR = common average growth rate**

**Source: International Monetary Fund – Financial Access Survey (IMF – FAS)**

The significant increase in the number of bank accounts between 2014 and 2017 was partly due to a change in the delivery mode of government social assistance programs introduced at the end of 2014. The new Joko Widodo administration changed the delivery mechanism of government-to-person payments (G2P) to around 1 million poor and vulnerable households from cash to non-cash and, hence, required the recipients to have bank accounts. The previous administration had established a database of the poorest 40% of Indonesian households which are eligible to receive various forms of government social assistance. Finance Ministry data suggest that the coverage of programs increased from 3.5 million families in 2015 to 6 million families by the end of 2016. The target is to cover all eligible families, around 15 million households, by 2019.

**Table 3. Indonesia's Usage Indicators for Financial Inclusion, 2004-2017**

FI Usage Indicators	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2004-2013	2014-2017
Outstanding deposits with commercial banks (% of GDP)	41.95	40.66	38.55	38.24	35.43	35.19	34.07	35.56	37.43	38.38	38.93	38.29	38.98	38.92		
Deposit accounts with commercial banks per 1,000 adults	490.23	504.01	456.60	462.64	472.40	493.09	572.90	623.10	694.82	858.04	900.78	934.10	1,055.58	1,564.24	6.42%	20.20%
Deposit accounts with commercial banks: o/w households per 1000 adults	480.67	492.72	446.07	450.50	458.34	476.47	555.30	602.75	660.32	830.65	873.62	908.86	1,029.68	1,536.79	6.27%	20.72%
Outstanding loans with commercial banks (% of GDP)	24.37	25.07	23.73	25.36	26.42	25.65	25.73	28.09	31.43	34.49	34.76	35.21	35.28	34.87		
Loan accounts with commercial banks per 1,000 adults	119.30	138.42	143.39	150.79	176.45	192.31	199.58	216.52	221.65	215.78	220.39	220.95	221.60	224.34	6.81%	0.59%
Loan accounts with commercial banks: o/w households per 1000 adults	116.46	134.69	138.07	146.27	171.96	189.58	196.38	213.59	218.74	212.45	217.25	218.15	219.21	222.10	6.91%	0.74%

**Source: International Monetary Fund – Financial Access Survey (IMF – FAS), various years**

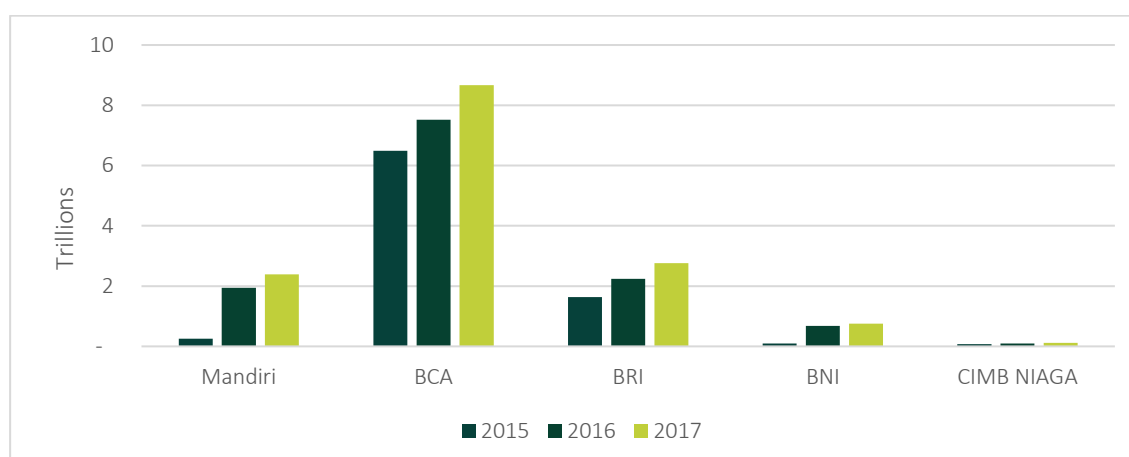
Meanwhile, the usage indicator of financial inclusion has grown only slightly since 2014. This poses a challenge for financial inclusion programs, namely how to encourage bank account holders to become active users of financial services such as paying bills, borrowing for business purposes, buying and selling, and other transactions. The World Bank Global Financial Index Survey shows that only 55% of Indonesians borrowed money in 2016, a slight decline from 57% in 2014. Borrowing from financial institutions increased from 9% in 2011 to 13% in 2014 and 17% in 2017. Borrowing from family members, meanwhile, stood at a much higher but declining rate, from 42% in 2011 to 41% in 2014 and 36% in 2017.

To increase financial inclusion, in 2016, the government promulgated the National Strategy for Financial Inclusion (SNKI). It includes schemes to encourage the financial services industry to increase the application of information technology (IT), such as digital financial services and branchless banking as well as other initiatives that aim to facilitate the growth of fintech-based financial services. The idea is that innovative technology can help to reduce costs and alleviate constraints such as geographical challenges, product mismatches, and/or a lack of trust that may hinder people from accessing financial services. This strategy is expected to promote more inclusive economic growth in the country.

In the two years since the SNKI was released, there have been some significant developments related to financial inclusion, such as the rapidly growing peer-to-peer lending, crowdfunding, payment (clearing and settlement) fintech, and other payment services such as GoPay and T-Cash. Banks have used digital innovations to find new ways to grow and to open up new business opportunities to provide a better customer experience (PwC 2018).

The shift to alternative digital financial services may reflect a strategic shift within the banking industry to lower the cost-to-income ratio by closing unprofitable outlets (DBS, 2018). The volume/nominal value of e-channel transactions (including ATMs, e-money, internet, and mobile banking platforms) has continued to increase since 2015. Figure 3 below depicts the nominal value of e-channel transactions from the country's five largest banks.

**Figure 3. Nominal Transaction Value of E-Channels (ATMs, Internet, and Mobile Banking) in Five Largest Banks in Indonesia (in trillion rupiah)**



**Source: Banks' annual reports, 2016-2018**

In addition, some banks have collaborated with fintech or start-up companies to keep up with their increasingly connected customer bases, such as the collaboration between BCA and GoPay, one of Indonesia's leading server-based electronic money systems. Others have released their own digital products, such as DBS' "DigiBank" and BTPN's "Jenius" mobile banking.

This implies that banks may have to compete with fintech companies to provide services that have hitherto been regarded as core banking services. There are three main categories of core banking services that are wide open to innovations (*Basel Committee on Banking Supervision, 2018, p. 9*):

- credit, deposit, and capital raising services, which include mobile banking and credit scoring;
- payment, clearing and settlement services, which include retail services such as mobile wallets, peer-to-peer transfers, and digital currencies, as well as wholesale services such as value transfer networks, FX wholesale, and digital exchange platforms; and
- investment management services which include high-frequency trading, copy trading, e-trading, and robot advice.

However, it should also be noted that this will likely increase financial inclusion, with fintech companies expected to provide services to groups that are underserved or unserved by traditional banks.

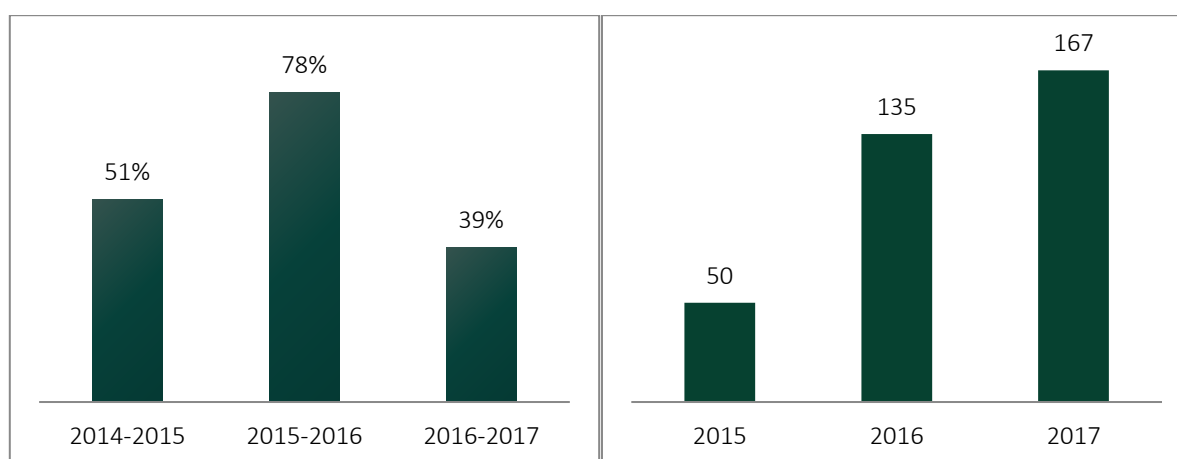
## 2.2 Bird's-Eye View of Fintech in Indonesia

There is a literature gap concerning the development of the fintech industry in Indonesia, which includes the business landscape, opportunities, and challenges faced by fintech companies. As a result, the assessment below relies primarily on available secondary data, the majority of which is gathered from survey results and consulting research reports.

As noted, despite having a rapidly expanding economy, a large young population base, and growing digital innovations, Indonesia still has a relatively high unbanked population and low account ownership (World Bank, 2017). The country, therefore, is seen as an untapped market for digital finance opportunities.

The development of the fintech industry in Indonesia started to gain attention in 2014 and continued to grow rapidly after that, reaching its highest growth at 78% in 2016 (Daily Social, 2017). According to Indonesia's OJK (OJK, 2018a), there is currently a total of 167 fintech companies operating in Indonesia.<sup>3</sup> This number has tripled in the past three years, from around 50 companies in 2015. Despite the growing number of companies, as of August 2018, only 64 of them had registered with the OJK as required.

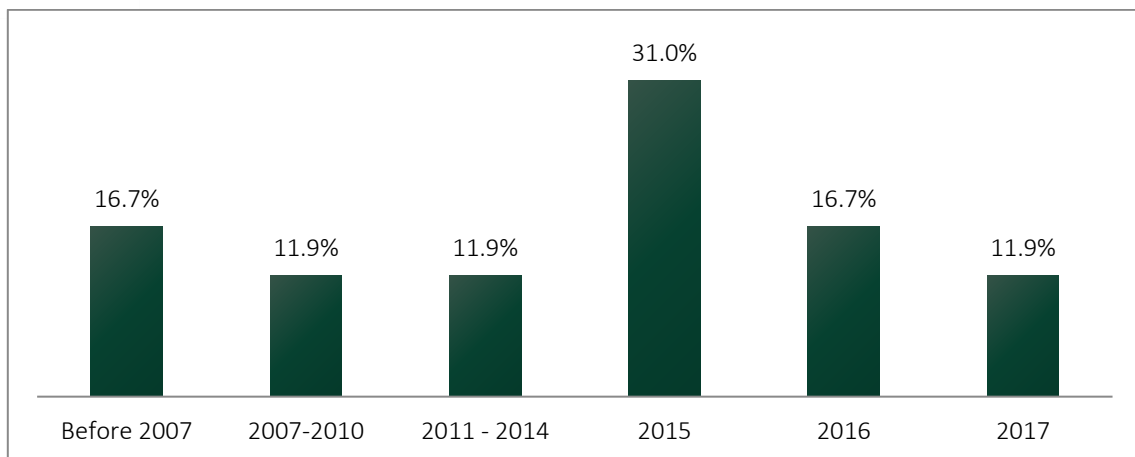
**Figure 4: Growth Rate and Number of Fintech Companies in Indonesia**



**Source: Financial Services Authority**

<sup>3</sup> We refer to the total number of fintech companies stated in the Fintech Singapore Report published in 2018. The Indonesian Fintech Association, however, states a slightly different number, with 149 registered fintech companies in 2018 (see <https://fintech.id/>).

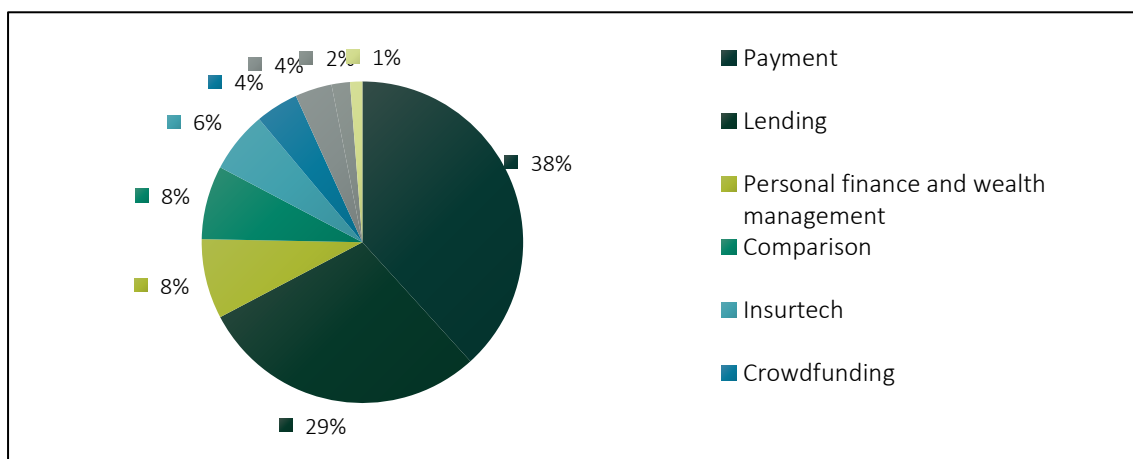
**Figure 5: Distribution of Fintech Companies Based on Establishment Year**



**Source: Daily Social Report**


Based on their business activities, Indonesia's fintech companies can be divided into a number of different subcategories. Digital payment companies account for the largest share at 38% of all fintech operators, driven primarily by the rise of online transactions due to the rapid growth of e-commerce, and recent shifts in consumption patterns from offline to online. Some of the popular digital payment services in Indonesia include mobile payments, payment gateways, e-money, and digital wallets/e-wallets.

**Figure 6: Distribution of Fintech Players in Indonesia Based on Business Activities**



**Source: Daily Social Report and Statista**

The growing demand for online payment services is not only captured by fintech companies, but also by non-fintech technology companies and traditional financial institutions i.e. conventional banks. A few examples are GoPay by Gojek, T-cash by Telkomsel (one of the country's biggest telecommunication companies), and Mandiri e-cash by Bank Mandiri. In



2016, Gojek acquired payment start-up PonselPay, which enabled it to use a digital wallet service (GoPay) to support its core business activities such as GoRide (motorcycle ride-hailing), and GoFood (food delivery).<sup>4</sup> In 2017, GoPay accounted for 30% of Indonesia's total digital payment transactions, which are estimated to be worth \$18 million.

The fintech industry has also experienced an increase in lending activities. Recently, there has been a rising demand for peer-to-peer (P2P) lending. To fill the gap, online P2P lending companies have been providing loans, especially to people who have been unable to secure loans from banks. In 2016, fintech companies raised approximately \$22 million from P2P business lending and over \$7 million from P2P consumer lending.

### 3 Methodology

As part of this study, we conducted a banking survey to collect primary data. The survey was carried out by distributing questionnaires specifically designed to capture the current state of digital technology adoption in the banking sector, as well as the perspectives and views of banks regarding the disruption of technology and the future of the banking sector.

There are 115 commercial banks in Indonesia, which are divided into four groups based on business activities and core capital classification, known as BUKU. Based on the aforementioned, banks are grouped as follows:

- BUKU I: Banks with core capital below Rp 1 trillion. They may conduct business activities only in rupiah, and/or are only eligible for activities as a foreign currency trader.
- BUKU II: Banks with core capital between Rp 1 trillion – Rp 5 trillion. They may conduct business activities in rupiah and foreign currencies.
- BUKU III: Banks with core capital between Rp 5 trillion – Rp 30 trillion. They are eligible for all business activities conducted both in rupiah and foreign currencies, as well as capital participation in financial institutions in Indonesia and the Asian region.
- BUKU IV: Banks with core capital above Rp 30 trillion. They are eligible for all business activities conducted both in rupiah and foreign currencies, as well as capital participation in financial institutions in Indonesia, and all over the world.

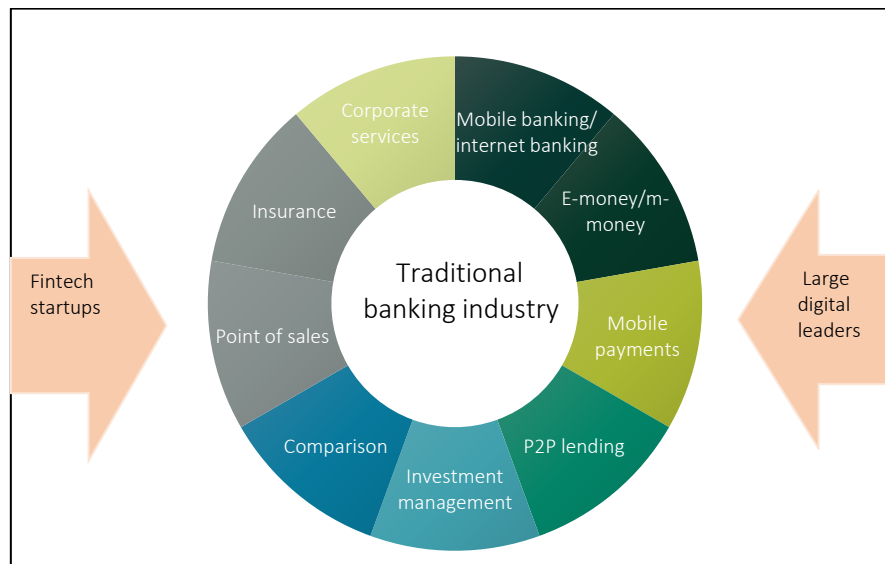
At the time of the survey, there were five BUKU IV banks, 28 BUKU III banks including one shariah bank, 60 BUKU II banks including nine shariah banks, and 22 BUKU I banks including four shariah banks. Ideally, the distribution of respondents represents the above distribution. However, most banks are reluctant to become survey respondents because that may entail giving out information about their activities.

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<sup>4</sup> <http://fintechnews.sg/10609/indonesia/fintech-companies-can-help-indonesian-banks/>

The questionnaire aimed to capture banks' motivation to adopt new technology. As noted, technological adoption in the banking sector may occur as banks' own initiative to improve their performance and productivity, or may be as a reaction to the emergence of technology-based financial companies. The figure below from Accenture depicts the process.

**Figure 7: Components of Disruptive Technologies in the Banking Industry**



**Source: Accenture, author's own**

In addition, the questionnaire aimed to capture banks' level of awareness of fintech development, as well as their perceptions about opportunities and challenges that fintech development presents. The questionnaire also intends to uncover banks' strategies for handling competition from fintech companies in various banking areas, such as core banking (credit/lending disbursement) and payment systems.

To complement the survey, the study also carried out in-depth interviews with fintech players in Indonesia. The interviews intended to capture fintech companies' views on fintech development in Indonesia. In addition, we also undertook a regression analysis using banking sector annual data to determine whether or not fintech development has had a tangible impact on banking sector efficiency.

## **4 Impacts of Disruptive Technology on Banks**

### **4.1 Analysis from Perception Survey Results**

This section covers three main parts. The first subsection discusses the current state of technology adoption in the banking sector. It will then move onto banks' level of awareness

of technology, specifically fintech services. This subsection focuses on banks' perceptions toward fintech services including general perceptions and the perceived impact of fintech services on the banking sector. The last subsection discusses the implication of fintech services on business competition, and how that affects banks' business strategies, employment structure, and financial regulations.

#### 4.1.1 Profile of Respondents

Twenty-seven commercial banks agreed to participate in the survey. There were four BUKU IV banks, 10 BUKU III banks, and 13 BUKU II banks in our sample. Because of their relatively small size and limited business activities, making them less likely to participate in the current wave of technology adoption, BUKU I banks are excluded. In terms of ownership status, the respondents are quite spread out, with more than half of respondents being private banks, followed by joint venture, state-owned, foreign, and regional banks. The table below depicts the characteristics of the survey respondents.

**Table 4: Sample Structure by Ownership**

Count		BUKU classification			
		II	III	IV	Total
Ownership	Private	8	5	1	14
	State-owned	0	1	3	4
	Regional	1	0	0	1
	Foreign	1	0	0	1
	Joint venture	3	4	0	7
	Total	13	10	4	27

**Table 5: Sample Structure by BUKU Classification**

Percentage (%)		BUKU classification			
		II	III	IV	Total
Ownership	Private	29.63	18.52	3.70	51.85
	State-owned	0	3.70	11.11	14.81
	Regional	3.70	0	0	3.70
	Foreign	3.70	0	0	3.70
	Joint venture	11.11	14.81	0	25.93
	Total	48.15	37.04	14.81	100.00

## 4.1.2 Adoption of Technology in Indonesia's Banking Sector

### 4.1.2.1 Current State of Fintech Utilization: Early Stage of Adoption

In the survey, we focused our attention on four different digital technologies that are prevalent in the banking industry—internet and mobile banking platforms, big data analytics, cloud computing, and blockchain. Our survey results indicate that the adoption of technology in the banking sector is still at an early stage. As seen in Table 6 below, approximately 89% and 41% of respondents have used internet and mobile banking and big data analytics, respectively. Meanwhile, a lower number of respondents have used cloud computing and blockchain, at 30% and 22%, respectively. As expected, the survey results also show that size matters; larger banks are more likely to adopt advanced technology than smaller ones.

**Table 6: Current State of Banks' Technology Adoption by Ownership**

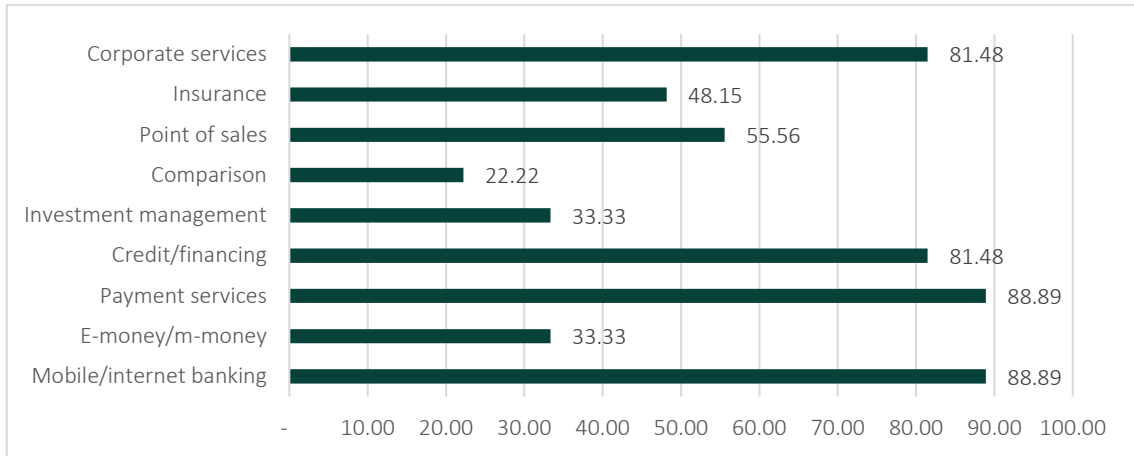
		Internet and mobile banking	Cloud computing	Big data analytics	Blockchain
Ownership status (%)	Private	40.74	11.11	22.22	3.7
	State-owned	14.81	14.81	14.81	7.41
	Regional	3.7	0	3.7	3.7
	Foreign	3.7	3.7	0	0
	Joint venture	25.93	0	0	0
Total		88.88	29.62	40.73	14.81

**Table 7: Current State of Technology Adoption by BUKU Classification**

BUKU (%)	BUKU II	76.92	7.69	15.38	7.69
	BUKU III	100	36.36	54.55	9.09
	BUKU IV	100	100	100	66.67

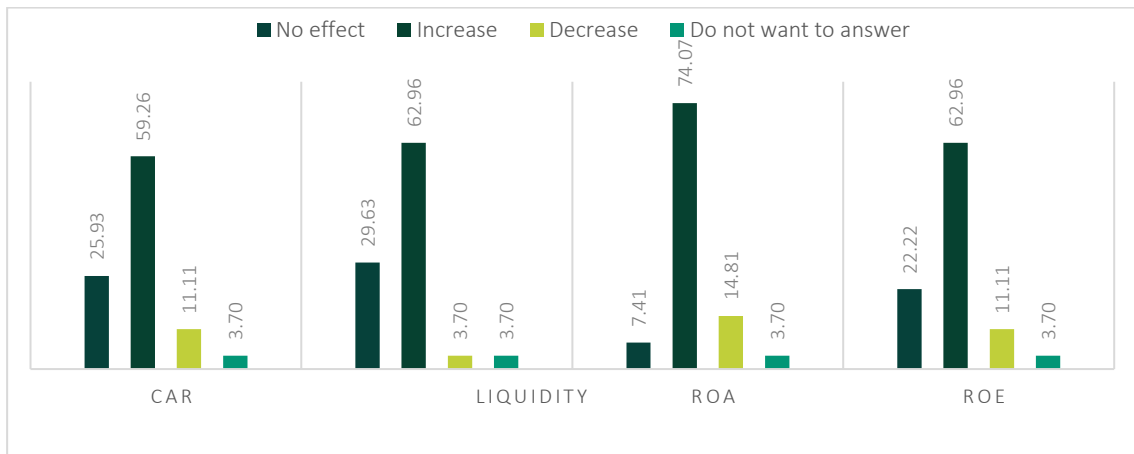
The above findings suggest that the primary focus of banks' digital technology adoption at this juncture focuses specifically on improving consumer banking and customer services and, hence, on internet and mobile banking as well as big data analytics. A closer look at the type of technology-based financial services that respondents claim to be delivering using digital technology seems to reinforce this. Approximately 89% of respondents say they have used mobile and internet platforms to provide their services. The same number of respondents say that they have used technology to provide payment services. An equal number of respondents (81%) say they have used technology to provide corporate and credit/financing services. However, it should be noted that this information does not detail the intensity of those applications.

**Figure 8: Financial Services Delivery that Uses Digital Technology**



Concerning the potential implications of fintech application on banks' performance, a majority of respondents say it would push banks to increase their capital adequacy ratio (CAR) and liquidity ratio, implying they consider that such an application entails some risks. It may also mean Indonesian banks are overly cautious, however. Nevertheless, most of them also say that fintech would increase bank profits, i.e. their return on asset (ROA), and return on equity (ROE) (see Figure 9).

**Figure 9: Potential Impact of Technology Adoption on Bank Indicators**



#### 4.1.2.2 Constraints to Technology Adoption

Considering the fact that Indonesian banks are just beginning to use financial technology, we investigate what they consider to be the main constraints that might prevent them from acquiring and utilizing digital technology in their activities. The survey results show that strict banking regulations, slow responses to new competition, concern about cybersecurity, and costly investment undertaking are four main factors which most banks (over 80%) deem as

either very serious or serious constraints to technology adoption. Note that investment in digital technology is expensive, especially for small banks. It is interesting to note that respondents consider strict banking regulations as a constraint that prevents them from using new financial technology, as there seems to be no regulation that discourages banks from using technology to enhance their service delivery. Meanwhile, it seems that a certain inertia pervades the industry, which tends to slow down banks' responses to new financial technology innovations. A lack of competition in the banking sector, as claimed by the respondents, is one indication of inertia in the industry.

**Table 8. Constraints to Digital Technology Adoption in Banking Sector**

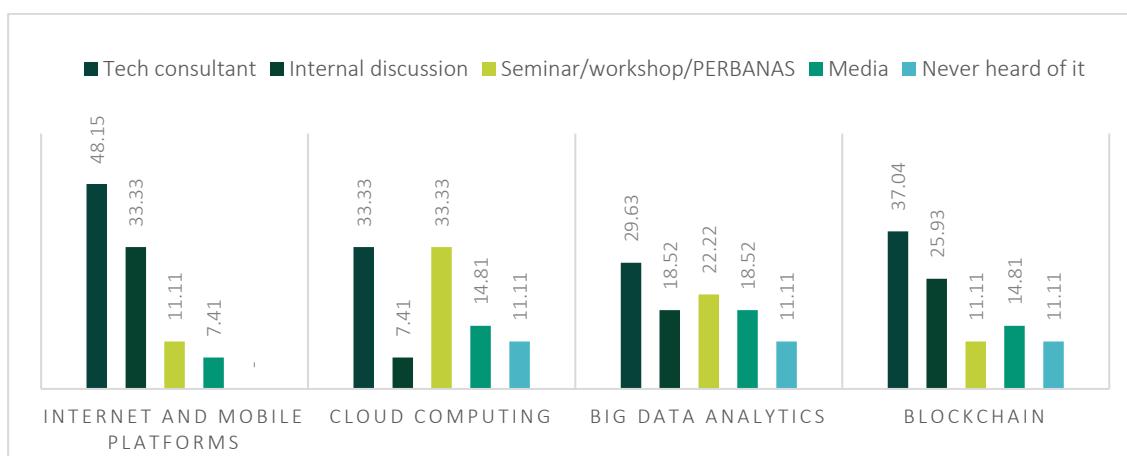
	<b>Very serious</b>	<b>Serious</b>	<b>Somewhat serious</b>	<b>Not serious</b>
<b>Strict regulations</b>	40.74	48.15	11.11	0
<b>Slow response toward competition</b>	14.81	70.37	11.11	3.70
<b>Cybersecurity threats</b>	25.93	55.56	18.52	0
<b>Costly investment undertaking</b>	51.85	29.63	18.52	0
<b>Not bank priority</b>	29.63	51.85	11.11	7.41
<b>Lack of access to technology</b>	22.22	48.15	14.81	14.81
<b>Lack of human resources</b>	29.63	40.74	22.22	7.41
<b>No digital strategy</b>	33.33	33.33	14.81	18.52
<b>Culture factors</b>	11.11	55.56	29.63	3.70

### **4.1.3 Awareness about Importance of Fintech Application in Banking Sector**

#### **4.1.3.1 Source of Information Regarding Fintech Services**

First, we wanted to find out through the survey how banks acquire information about the current state of fintech. A significant fraction of the respondents say they acquire such information from technology consultants and, to a lesser extent, from internal discussions and seminars/workshops. For instance, with regard to internet and mobile banking platforms, about 48% of the respondents obtain information from technology consultants, 33.33% from banks' internal discussions, 11% from seminars and workshops, and 7.41% from the media (see Figure 10).

**Figure 10: Banks' Sources of Information about Fintech**



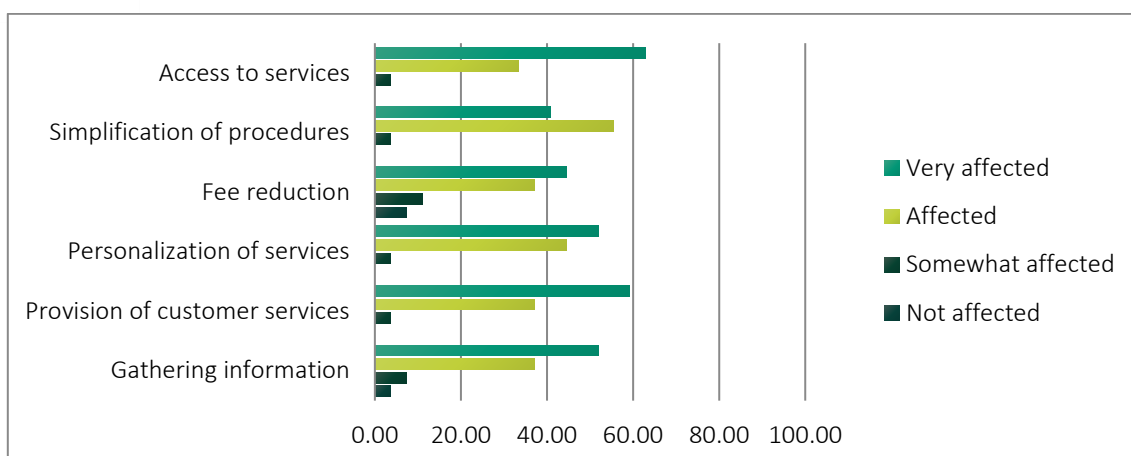
#### 4.1.3.2 General Perceptions of Fintech Services

We also wanted to know how banks perceive the importance of fintech innovations within, as well as outside, the banking sector, i.e. whether such developments are good (positive) or bad (negative) for the banking industry as a whole. A large majority of the respondents perceive fintech services favourably. That is, 48% of them claim that fintech will have a very positive effect and another 48% say that it will have a positive impact on the banking sector. Only a very small number of respondents, approximately 4%, perceive the application of fintech negatively.

Meanwhile, the survey also finds that fintech will have different impacts on different banking services. In particular, a large fraction of the respondents say that fintech will improve access to banking services and the way such services will be delivered in the coming years. At the same time, a somewhat lower percentage of them say fintech will have positive impacts on the personalization of services, simplification of procedures, fee reduction, and information gathering. However, there are a small fraction of banks that believe fintech will not affect information gathering and fee reduction.<sup>5</sup>

<sup>5</sup> Findings from PwC's digital banking 2018 survey also reported customer services and customer acquisition as top focuses for digital strategy in Indonesia's banking sector.

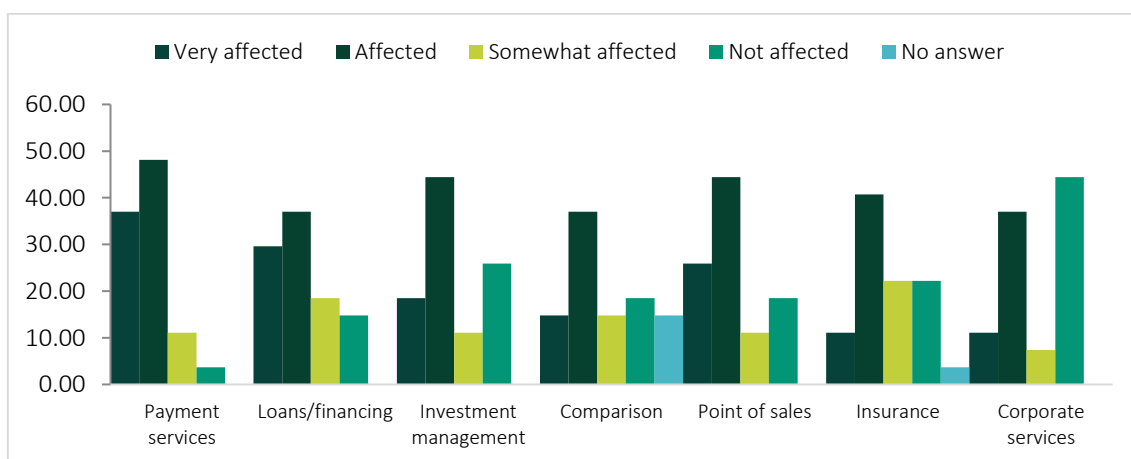
**Figure 11: Impact of Fintech Services on Customers' Banking Experience**



On the same note, our survey results also reveal that respondents believe fintech services considerably affect traditional banking services. Almost half of the respondents believe that payment services, loans, and points of sales will be the most affected by new technologies.

Indeed, with the development of digital payment platforms, such as GoPay and OVO, the provision of payment services is evolving rapidly and disrupting traditional channels provided by banks, such as branch offices. Note that GoPay and OVO belong to technology-based companies. It is interesting to know how banks would react to the emergence of competition from non-traditional financial services providers, i.e. fintech companies. In the next section, we will discuss whether banks view fintech services as competitors or business opportunities.

**Figure 12: Impact of Fintech Services on Banking Products**

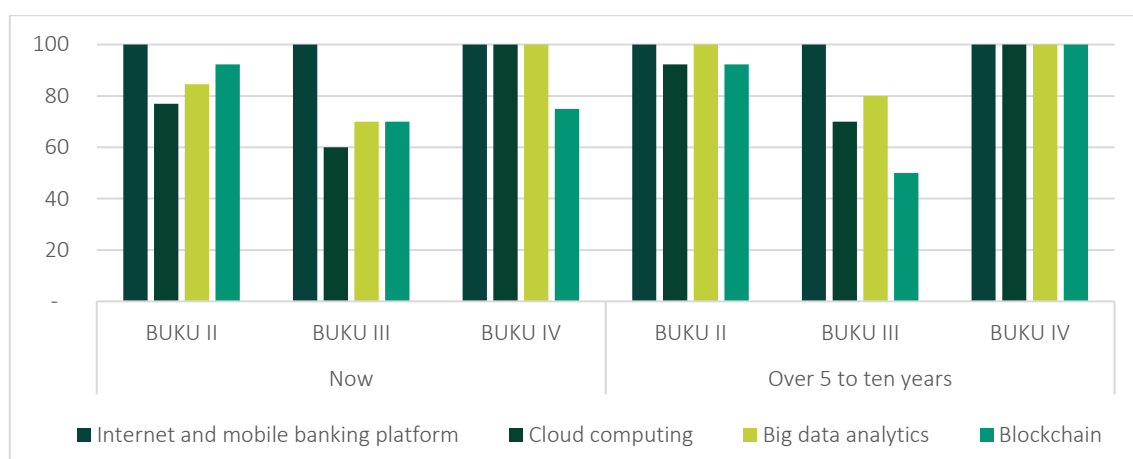


#### 4.1.3.3 The Importance of Technology in the Future

Notwithstanding the early stage of fintech development, most respondents are well aware of its importance for the future of the financial industry, and the banking industry in particular. Currently, most banks focus their attention on acquiring internet and mobile platforms, big

data analytics, and cloud computing. Meanwhile, over the next five to 10 years, respondents increasingly anticipate the emergence of blockchain, aside from the aforementioned technologies. Respondents from larger banks, such as those under BUKU IV (100%) expect significant application of blockchain, compared to smaller banks under BUKU II (92%) and BUKU III (50%). Note that, unlike BUKU II and BUKU IV banks, there is a higher percentage of BUKU III banks that consider blockchain to be important now than perceive it will be important in the future. The reason for this discrepancy is not immediately clear.

**Figure 13: Perceptions about Importance of Fintech Now and in the Future**



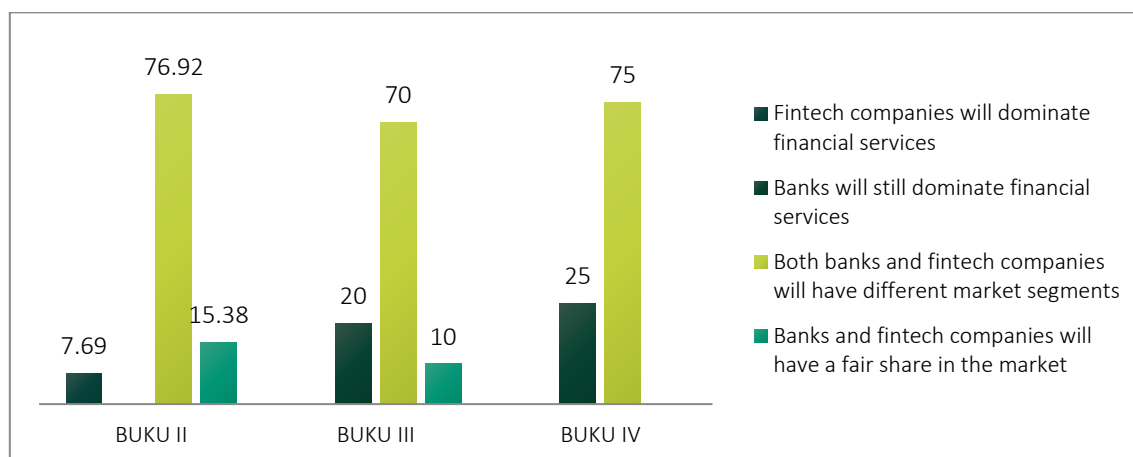
#### 4.1.4 Implication of Fintech Services for Indonesia's Banking Sector

##### 4.1.4.1 Implications for Banks' Business Competition

In this section, we aim to learn about banks' assessment of how fintech services will affect competition in the financial industry. In particular, the survey intends to understand banks' attitudes toward emerging competition from fintech companies, and how such competition will reshape their business strategies.

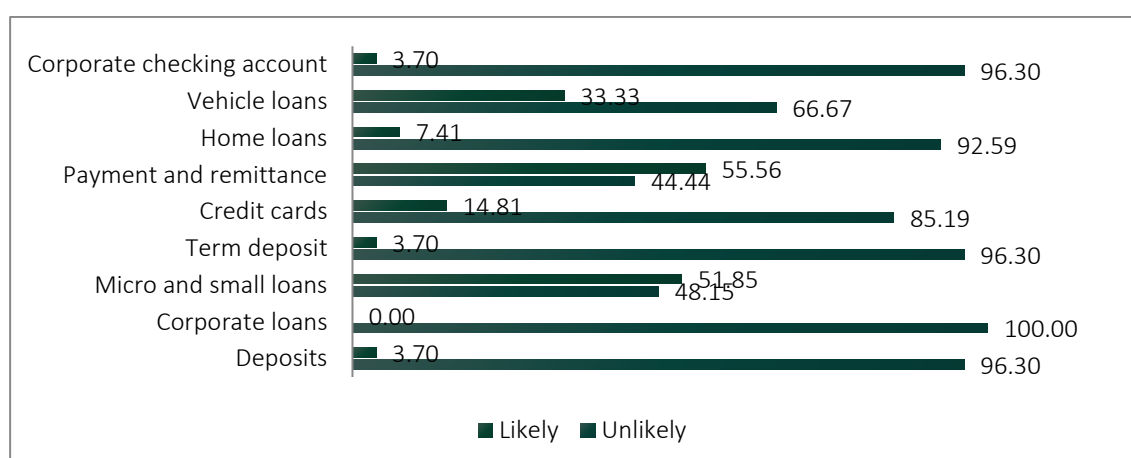
Based on our survey results, the majority of respondents do not consider competition from fintech companies to be a serious threat to their businesses. Approximately 77% of BUKU II banks, 70% of BUKU III banks, and 75% of BUKU IV banks believe that banks and fintech companies will operate in different market segments. Some larger banks, however, believe that banks will continue to dominate financial services.

**Figure 14: Perceptions about Business Competition**



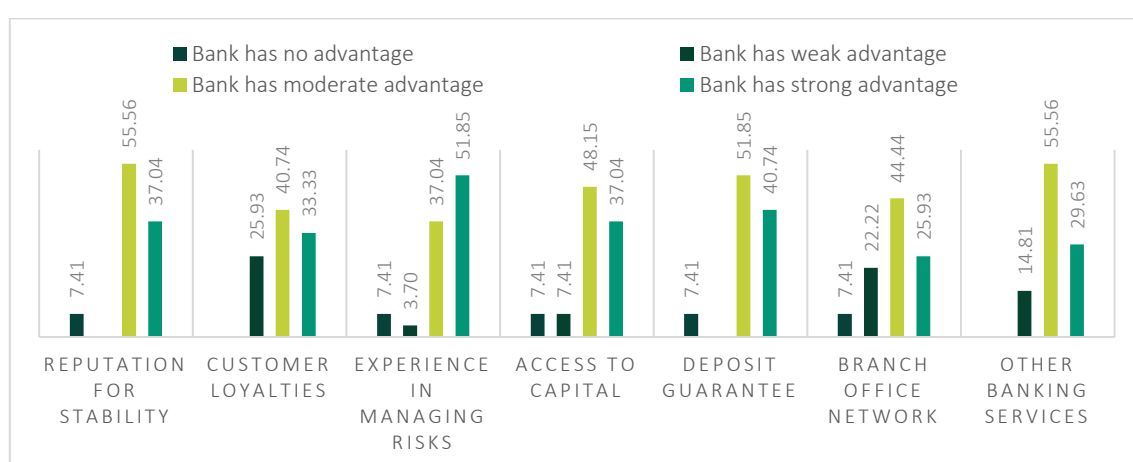
When asked specifically about which financial services are most likely to be dominated by banks, most respondents say corporate loans, deposits including term deposits, and corporate checking accounts will continue to be controlled by banks. When asked which financial services are most likely to be taken over by fintech companies, nearly 56% of respondents cite payments and remittances, 52% identify micro and small loans, and 33% of respondents mention vehicle loans (Figure 15). Such responses are consistent with the aforementioned points suggesting that banks and fintech services will serve different market segments. This is also reflected in our in-depth interviews with fintech players, as fintech companies believe that they are not competing head-to-head with banks, at least for now. Currently, fintech companies focus on short-term financing such as P2P lending, which is mostly concentrated on consumption loans and productive loans.

**Figure 15: Banking Services Most and Least Likely to be Affected by Fintech Services**



In order to understand the reasons behind the perceptions of banks outlined above, the survey also asks about the advantages of banks over fintech companies. Most respondents consider their reputation for stability (93%), deposit guarantee (93%), and experience in managing risks (89%) as banks' main competitive advantages over fintech companies. Some have also stated that banks provide greater access to capital in comparison to fintech companies. From these particular survey results, it will be interesting to see whether the trend will change over the next five years or so, considering the rapid development and long-term strategy of fintech companies. As mentioned in our in-depth interviews, long-term financing will be part of fintech's business strategy in the future.

**Figure 16: Advantages of Banks over Fintech Companies**

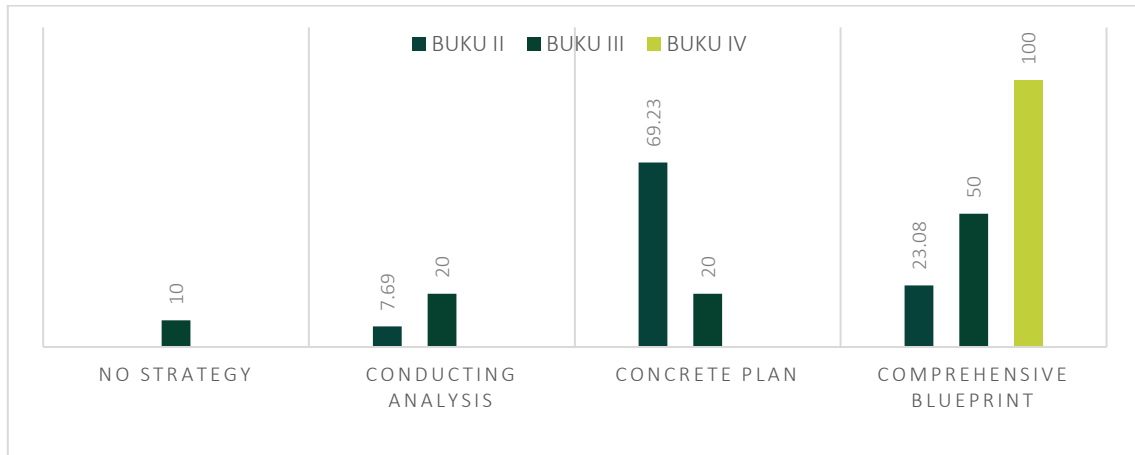


#### 4.1.4.2 Implications for Banks' Business Strategies

In this section, we intend to focus on banks' business strategies in response to the emergence of new financial technologies. We want to capture the level of readiness across banks and the likely strategies that will develop to face such an eventuality.

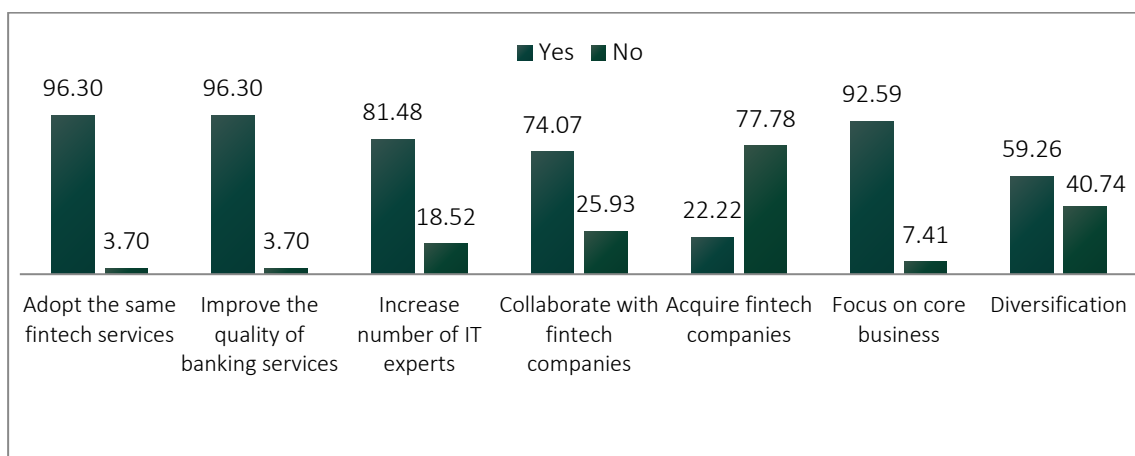
Most respondents say they are in the process of developing digital strategies. Almost half of the respondents, about 44%, claim to have a comprehensive blueprint, while 40% have a concrete plan, 11.4% are conducting analysis, and only 3.7% said they had not yet done anything. When we look more closely at banks' profiles, it comes as no surprise that larger banks are the most prepared. All BUKU IV respondents, 50% of BUKU III and 23% of BUKU II respondents say they already have comprehensive blueprints.

**Figure 17: Banks' Digital Strategies**



Next, we investigate the types of strategies that banks have implemented or will develop in response to competition from fintech companies. In line with the previous points, we discover that banks indeed have tangible ideas about how they will respond to the rise of fintech. More than 95% of respondents say they will develop the same fintech services as well as improve the quality of their services. Meanwhile, around 93% say they will focus on banks' core business. Also, a large fraction of banks are considering increasing the number of IT experts or reducing operational costs to become more efficient (not shown), or doing both. Quite a large number of banks say they will collaborate with fintech companies (74%). Finally, around 59% of banks say they will diversify their services.

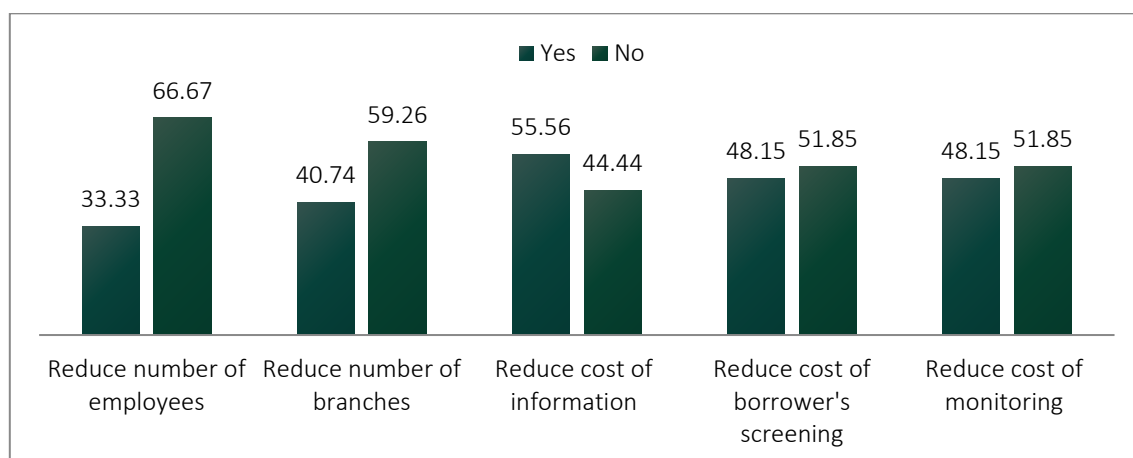
**Figure 18: Banks' Strategies in Response to Rise of Fintech Companies**



Banks were also asked to elaborate further on how they will reduce their operational costs. The majority of banks say they will reduce the number of employees and cut the number of branches. A significant percentage say they will reduce the costs of information gathering,

borrower screening, and monitoring. Note that each of these actions may entail a greater loan risk.

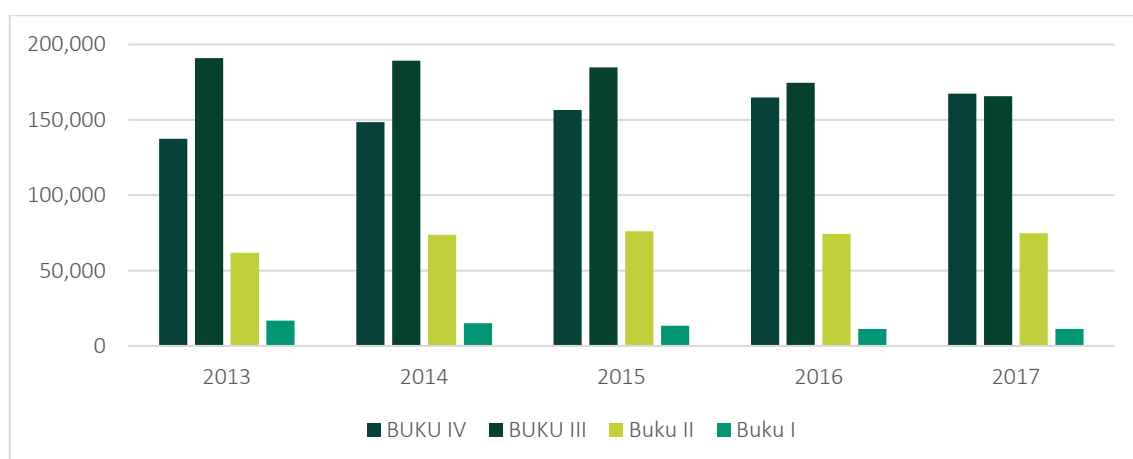
**Figure 19: Banks' Cost-Reduction Strategies**



#### 4.1.4.3 Implications for Banks' Employment Structure

To complement our survey result we also collected recent data on banks' employee numbers based on the banks' annual reports. The data reveals that the total number of permanent employees in the sector grew only slightly by 0.74% per year between 2013 and 2017. The breakdown is as follows: BUKU IV and BUKU II banks managed to increase their number of permanent workers by 5.05% and 4.92%, respectively, while BUKU III and BUKU I banks reduced their pool of permanent workers by 3.49% and 9.49%, respectively, per year in the period of 2013-2017.

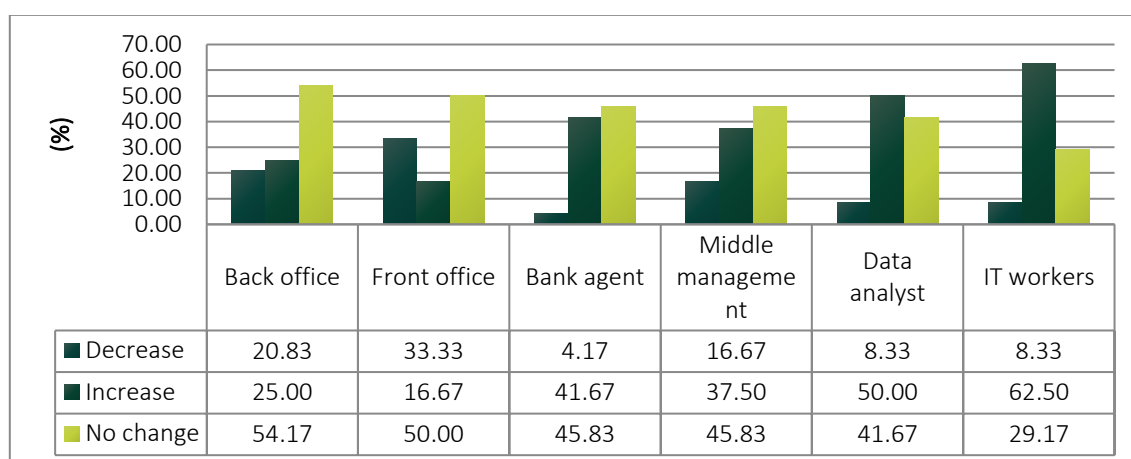
**Figure 20: Number of Permanent Employees in Commercial Banks, 2013-2017**



Source: Banks' annual reports, 2013-2017

Notwithstanding the presence of technology and how it is driving business strategy toward a customer-centric approach, the impact on employment structure within banks remains imperceptible. Approximately half of the banks report no changes across all job types, except those related to technology such as data analysts and IT workers. This is contrary to the growing concern that disruptive technology such as digitalization has the potential to displace jobs, in particular putting at risk jobs that require low to medium skills such as front office staff (tellers and administrative staff).

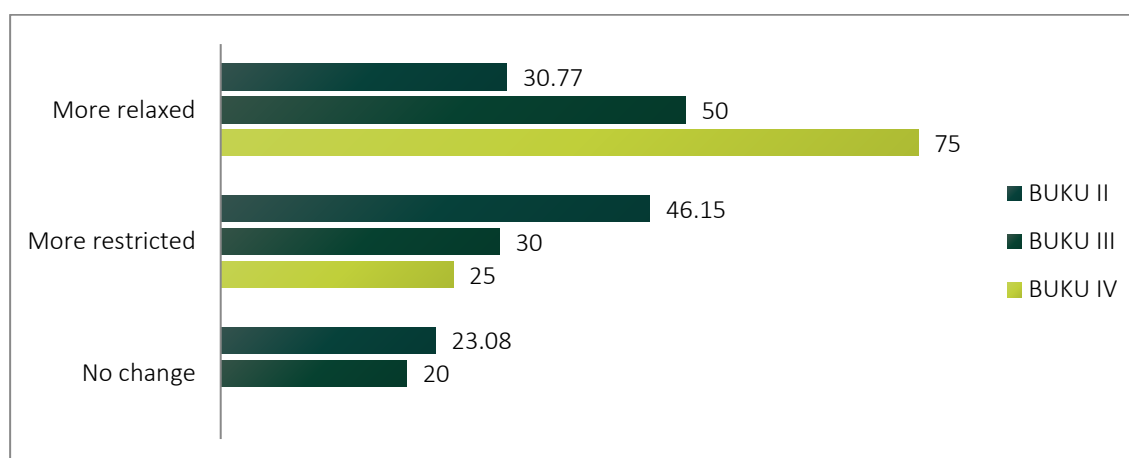
**Figure 21: Impact of Technology Adoption on Banks' Employment Structure**



One possible explanation for this trend is employment reallocation within banks. With the development of technology, it might be that banks are reallocating workers to divisions that require more human interaction such as bank agents (in the survey, we define bank agents as branchless banking agents) and marketing, which is difficult to replace with digital products and services. However, as expected, when banks are asked about the prospects for employment within the next five years, we see an increasing number of respondents reporting the possibility of structural changes, particularly an increase in technology-related jobs, and reductions in front and back office jobs. This might explain banks' business strategies, which are shifting to technology-based and innovative banking services.

#### 4.1.4.4 Implications for Financial Regulators

**Figure 22. Perceptions of Banks Towards Regulations**




Last, we also aimed to find out what banks want the regulator to do in response to the rise of fintech services. Although respondents do not consider fintech companies to be competitors, the majority of respondents want more relaxed banking regulations. This is especially true for larger banks, i.e. BUKU IV and BUKU III banks. Meanwhile, a significantly large fraction of smaller (BUKU II) banks prefer more restricted regulations. One possible explanation for this finding is that larger banks are more likely to adopt new technologies than smaller ones. Recall that banks consider strict banking regulations to be a major constraint to technology adoption.

### Box 1. Fintech Interviews

During the course of this study, we managed to interview two fintech companies. Both companies provide P2P lending services but cater to different borrower categories.

The first company was established in October 2015 and began lending activities in March 2016. It has 146 employees and its main clients are medium-size producer companies. It has around 12,000 lenders that have provided loans to borrowers at least once. Of this number, there are around 2,000 active lenders that provide loans every month. Every month the active lenders provide loans of around Rp 100 million on average, or around Rp 200 billion in total.

Currently, there are around 1,200 mostly repeat borrowers. The company takes invoices issued by buyers of the borrower's products as collateral. Loan applications are done online and it takes only one day for the credit committee to approve or reject an application. This is much faster than banks' loan approval procedures. For invoice financing, the company charges around 16% interest per annum, which is quite competitive compared to banks.



The second company was established in 2010 as a microfinance cooperative and its operation became fully digitalized in 2016. It has 113 branches across Java and has around 1,000 full-time employees, of which 150 are based at the company's headquarters and the rest are in branch offices.

It provides group lending to around 250,000 women-only clients in rural areas across Java. Every group consists of between 15 and 20 members, supervised by a business partner. Each client can borrow between Rp 3 million and Rp 10 million. Currently, the company has around 800 business partners, around 65% of whom are women. Each business partner serves between 200-300 clients.

For five years between 2010 and 2015, i.e. before the company turned digital, it provided loans amounting to Rp 30 billion to 9,000 borrowers. Within two years following its digitalization, the company managed to secure 170,000 new clients and disbursed around Rp 850 billion worth of loans. Such is the impact of digital technology.

Both companies state that OJK's regulation on the fintech industry is reasonable. Both also state that the most severe constraint they face is a shortage of IT workers, especially more experienced ones. In addition, they argue that poor telecommunications infrastructure and internet connection, especially in regions outside Java, have severely hindered their services. Currently, the two companies operate only in Java.

## 4.2 NIM as Efficiency Indicator and its Determinant Factors in Indonesia's Banking Sector

To complement our survey findings, we also conducted a regression analysis using secondary data. The aim is to see whether fintech development in the country has already had any impact on banks' performance. In particular, we examine whether there is a significant correlation between the development of fintech services and banks' efficiency. We test a hypothesis that fintech services have tangible impacts on banks' efficiency using NIM<sup>6</sup> as an indicator of banks' efficiency.

Ho and Saunders (1981) develop a model to explain the determinants of NIM. They find that the level of risk aversion, market power, and variance in loan and deposit interest rates have significant impacts on NIM. Several extensions of the model also find that market power (Maudos and Solis, 2009) and operational cost (Maudos and Guevara, 2004) have significant impacts on NIM. The findings of these studies are important not only to understand how various factors affect NIM, but to understand how financial policies might affect banks' performances.

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<sup>6</sup> NIM is defined as the spread between interests earned and disbursed. Sometimes it refers to the measure of costs of intermediation.

As explained in previous sections, Indonesia has a persistently high NIM. Sidabalok and Viverita (2011) use an extension of Ho and Saunders (1981) and Maudos and Solis (2009) models to estimate the determinants of NIM in Indonesian banks. They find high market concentration, inadequate quality management, and high operational costs as key contributors to the high NIM trend in Indonesia.

In this study, we use Sidabalok and Viverita's model with minor modifications to test the abovementioned hypothesis.

### Econometric model

This paper applies the extension of Ho and Saunders' (1981) model to identify factors that affect NIM. The total sample used in our econometrics model is 1,350 commercial banks' data from 2005 to 2017. The data is adjusted for liquidated and merger banks during the period. Note that the number of banks in 2005 is larger than that in 2017 because some of the banks have either been liquidated or merged with other banks. The number decreases when we use a dynamic panel data model as the model includes lagged variables in the independent variables. The dynamic panel data model used in this paper follows closely the study of Sidabalok and Viverita (2011) and Maudos and Solis (2009), which is described as follows:

$$NIM_{it} = \beta_0 + \beta_1 NIM_{it-1} + \beta_2 Lerner_{it} + \sum_k \beta_k X_{kit} + \mu_i + \varepsilon_{it}$$

$NIM_{it}$  : Net Interest Margin

$Lerner_{it}$ : Lerner index

$X_k$  : Control variables including quality management, specialization, opportunity, implicit interest, credit risk, size of banks, liquidity, dummy fintech, GDP growth, and inflation

$\mu_i$  : Unobservable heterogeneity

$\varepsilon_{it}$  : Error term

The description of each variable is attached in Appendix 1.

### Study findings

In this paper we use two different regression models. They are:

#### 1) Fixed effects model

$$NIM_{it} = \beta_0 + \beta_1 Lerner_{it} + \sum_k \beta_k X_{kit} + \mu_i + \varepsilon_{it}$$


$NIM_{it}$  : Net Interest Margin

$Lerner_{it}$ : Lerner index

$X_k$  : Control variable including quality management, specialization, opportunity, implicit interest, credit risk, size, liquidity, dummy fintech, GDP growth, and inflation

$\mu_i$  : Unobservable heterogeneity

$\varepsilon_{it}$  : Error term



The fixed effects model is an option as it will absorb individual effects from an unobservable heterogeneity variable. By using a fixed effects model, one assumes that an individual observation has unique characteristics that may affect either the predictor or outcome variables. However, these characteristics are invariant over time (examples of these for people are characteristics such as race and gender). The use of a fixed effects model removes the effect of those time-invariant characteristics into intercepts, so that we can assess the net effect of the predictors on the outcome variable.

2) Dynamic panel data model (GMM difference and system)

$$NIM_{it} = \beta_0 + \beta_1 NIM_{it-1} + \beta_2 Lerner_{it} + \sum_k \beta_k X_{kit} + \mu_i + \varepsilon_{it}$$

The dynamic panel data model has a lagged dependent variable as its independent variable ( $NIM_{it-1}$ ). It implies that the value of current NIM is also affected by the value of NIM in the previous year. The Generalized Method Moments (GMM) is chosen rather than the fixed effects method in dynamic panel data as fixed effects cannot absorb the endogeneity problems arising from a lagged dependent variable. Accordingly, we use Arellano and Bover (1995) and Blundell and Bond's (1998) methods which propose estimating the equation in first differences and levels obtained from the system GMM estimator.<sup>7</sup> Furthermore, we need to verify the validity of the instruments and test for serial correlation (Arellano and Bond, 1991), i.e. to determine whether we produce consistent estimators. For this, we use the Sargant test and the results indicate the model is valid.

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<sup>7</sup> Consider a model containing a lagged dependent variable and a single regressor X:  $y_{it} = \beta_1 + \rho y_{i,t-1} + X_{it}\beta_2 + u_i + \varepsilon_{it}$ . The first difference transformation will be:  $\Delta y_{it} = \rho \Delta y_{i,t-1} + \Delta X_{it}\beta_2 + \Delta \varepsilon_{it}$ . The constant term and individual effect were removed. This method of estimating first difference was suggested by Arellano and Bond (1991). It is, however, able to be biased when instruments are weak because it makes use of the information contained in differences only. In a 1998 paper by Blundell and Bond, they suggested making use of additional level information. The combination of moment restrictions for differences and levels results in an estimator called the GMM system estimator.

**Table 9: Expected Signs for Each Variable**

Number	Variables	Magnitude	Variable Definition
1	Risk averse	Positive	Total equity/total asset
2	Market concentration	Positive	Lerner index
3	Quality management	Negative	BOPO
4	Specialization	Positive	Total credit/total asset (1) and total deposit/total asset (2)
5	Opportunity	Positive	Operational expense/total asset
6	Implicit interest	Positive	Administration expense/interest expense
7	Credit risk	Positive	NPL
8	Size	Negative	Natural log of total asset
9	Liquidity	Positive	LDR
10	Dummy fintech	*	Variable is accounted for 1 from year 2014
11	GDP	*	GDP growth
12	Inflation	Negative	CPI inflation

**BOPO = operating expense to operating income ratio, NPL = non-performing loan, LDR = loan to deposit ratio, GDP= gross domestic product, CPI = consumer price index**

**Table 10: Regression Results from Estimation of Static and Dynamic Panel Data**

Variables	With Dummy Fintech	
	Fixed effects	GMM System
	NIM	NIM
L.nim		0.725*** (0.00777)
risk_averse2	0.294 (0.907)	6.688*** (0.461)
lerner	18.83*** (2.891)	8.719*** (1.057)
quality_management	0.0225** (0.00958)	-0.0168*** (0.00364)
special1	0.00968 (0.00631)	0.0494*** (0.00389)
special2	0.00230 (0.00834)	0.0101*** (0.00341)
credit_risk	0.0206 (0.0202)	-0.0563*** (0.00645)
opportunity	0.120*** (0.0137)	0.141*** (0.00520)
implicit_interest	0.00820*** (0.00105)	0.00475*** (0.000627)
size	0.0470 (0.113)	-0.691*** (0.0383)
liquidity	-0.00236 (0.00259)	-0.00274*** (0.000802)
gdp	0.0273 (0.122)	0.299*** (0.0286)
inf	0.0818*** (0.0238)	-0.0772*** (0.00663)
dummy_fintech	-0.532*** (0.187)	0.643*** (0.0362)
Constant	-12.32*** (3.449)	0.821 (1.210)
Observations	1,335	1,007
R-squared	0.182	
Number of ID	106	105

**NIM = net interest margin**

**Notes: Robust standard errors in parentheses**

**\*\*\* p<0.01, \*\* p<0.05, \* p<0.1**




Table 10 shows the regression results obtained from both fixed effects and dynamic panel data model that we use to estimate the determinants of NIM for commercial banks in Indonesia.

### **Fixed effects model**

Using the fixed effects model, the results indicate that variables such as the Lerner index, opportunity, implicit interest, and inflation have positive and significant coefficients at a 1% confidence level. Meanwhile, the dummy fintech variable has a negative and significant impact on NIM. Credit risk also shows a positive impact on NIM but at a 5% confidence level. The rest of the variables do not have any significant impact on NIM.

### **GMM method**


The results of the regression using the dynamic panel data model show that each variable obtains the expected signs in accordance with the original hypothesis, except for credit risk (credit risk). Overall, our findings suggest that market structure, level of risk aversion, and NIM from previous periods are key determinants of NIM in Indonesia from 2005 to 2017.

The coefficient of the Lerner index is positive and statistically significant at a 1% level. This implies that market competition strongly affects NIM. Under conditions in which the market is highly concentrated, a lack of competition may result in higher NIM. In other words, the market structure allows banks with greater market power to have a stronger influence in determining NIM.<sup>8</sup>

The regression result also shows a positive and statistically significant relationship between the level of risk aversion and NIM, which is consistent with previous findings by Ho and Saunders (1981). This indicates that Indonesian banks are more reluctant to take risks (risk averse) and, hence, will set higher NIM. The result is expected as Indonesian banks tend to be risk averse and have cautious behavior.

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<sup>8</sup> The Lerner index as a competition measure is well-known for its simplicity in signaling market power and efficiency through a price-cost margin mechanism. As pointed out in his paper, Leon (2014) argued the Lerner index poses interesting advantages compared to other non-structural measures. The Lerner index illustrates the ability to measure individual market power by quantifying banking pricing behavior that allows analysis to be bank-specific and vary over time. The indicator also allows market power to be measured separately for different market segments and products. However, not unlike other competition measurements, the Lerner index has its limitations. Some argue the index is not a proxy of competition, but rather pricing market power, where in some cases, an increase in market power can be consistent with an increase in competition. Another concern over the Lerner index is the inability to capture the substitutability of products.




In terms of quality management, we use an operating expense to operating income ratio (BOPO) to see whether there is any significant impact on banks' efficiency. The result indicates the variable has a negative and statistically significant relationship (statistically significant at a 1% level) with NIM, such that higher quality management may result in banks charging lower NIM. The result is in line with the hypothesis that with better quality management, banks are more efficient in managing their operations and minimizing costs, which results in lower NIM. Interestingly, a recent study by DBS (2018) shows that banks can reap benefits from technological adoption, i.e. digitalization, which will lower operating expenses. By utilizing technology, banks can improve quality management and reduce operational expenses, thus enhancing their profitability and efficiency.

As for bank-specific characteristics, other variables that significantly affect NIM are special1 and special2—total loans/total asset and total deposit/total asset—with the correct predicted positive influence, which is also found in other studies such as that of Carbo and Rodriguez in 2007. The coefficient of specialization is statistically significant for both loans and deposits. Other variables such as opportunities to hold reserve and implicit interest show a positive and statistically significant relationship, while the size of banks indicates a negative and significant effect on NIM.

Meanwhile, credit risk, which is measured by NPL, is expected to show positive signs. Theoretically, banks that bear a greater credit risk will set higher NIM to cover faulty credits. However, our regression results show a negative and significant relationship between credit risk and NIM. Banks might be very risk-averse so that once credit risk increases, their main goal is to maintain stability, while at the same time reducing their profitability. Other studies that examine the behavior of banks in Latin America also show similar regression results. The impact of NPLs on the spread of banks in countries such as Argentina and Peru seems to be negative. The paper argues that one possible explanation is the inadequate provisioning for loan losses, which might also reflect the behavior of banks in deflecting the issue of high bad loans (Brock and Suarez, 2000).

In addition, with the development of disruptive technology, we try to capture the effect from the development of fintech services on NIM. We use the dummy variable for fintech services for the period 2014-2017 and found a positive and statistically significant (at a 1% level) relationship between fintech and NIM. However, it is worth noting that during the same period, there was also an increasing trend for NIM. This implies that the model might capture the effect from the increasing NIM instead of the dummy variable for fintech. Another plausible argument is the impact from fintech is not yet significant on NIM, at least for the time being.

Lastly, for macroeconomic indicators such as GDP growth and inflation rate, the regression results obtained show a significant effect on the determination of NIM. As seen in Table 3, an increase in economic growth as proxied by GDP growth has a positive impact on NIM, while an increase in the inflation rate has a negative impact on NIM. Interestingly, this result differs from previous literature (see Sidabalok and Viverita, 2011), which found macroeconomic variables as minor contributing factors to the determinants of NIM in Indonesia's banking system.



One possible explanation is that when the economy is growing, there is a higher demand for money or loans, which in turn increases the price of funds. In addition, higher economic growth may also lead to an increase in the supply of funds (deposits), which may lead to a lower deposit rate due to an excess supply of deposits. Assuming that the deposit rate remains low, a higher loan rate will result in larger interest spread, or higher NIM.

## 5 Conclusion and Recommendations

This study is based primarily on a firm-level survey capturing banks' perceptions of the emergence of digital technology-aided financial services, or fintech. The main objective of the study is to assess banks' strategic responses to such innovations in the industry.


The utilization of fintech in the banking sector is still at an early stage of development. Nevertheless, the overwhelming majority of respondents consider the digitalization of banking services as important. Most banks agree that fintech will become even more important in the future. As expected, larger banks are better prepared to adopt and apply new technology than smaller ones, arguably because larger banks have more resources to acquire fintech and necessary human resources, i.e. IT workers. High development costs and a lack of necessary human resources are among the main constraints for banks in adopting fintech. Another constraint is concern about cybersecurity. One immediate conclusion from this finding is that smaller banks may find it difficult to keep up with fintech innovations, which may lead to consolidation in the banking sector.

Note that fintech companies also consider a shortage of IT workers and inadequate telecommunications and internet infrastructure, especially in regions outside Java, as the main constraints hindering their development. This is likely to have a significant implication for any efforts to increase financial inclusion through banks as well as through fintech companies. Note that only around 50% of Indonesians have bank accounts. It is for this reason that financial authorities have been promoting digital financial services and branchless banking as ways to increase financial inclusion.

There is currently little concern that fintech development will lead to a large-scale reduction in banking sector employment. But that is perhaps because, as noted, fintech development is still at an early stage. Further into the future, banks may have to reduce jobs that no longer suit their needs, such as front and back office jobs. At the same time, banks may want to increase other jobs, especially IT-related roles.

On this note, we make the following recommendations.

First, financial authorities may want to encourage banks to expedite their adoption of digital technologies, so as to improve the quality and coverage of their services. In this respect,



relevant authorities should pay attention to constraints that, according to banks, are impeding the development of fintech services within the banking sector. Admittedly, some of the specified constraints such as high development costs and a shortage of IT workers may be beyond their capacity to resolve directly. However, by working together with industry, they may be able to find ways to address the issues. For instance, they could encourage banks to undertake in-house training for IT workers.

Second, another issue that requires closer cooperation between relevant authorities and banks is cybersecurity. A cybersecurity breach in one bank could have implications for financial stability. Such cooperation will become more important in the coming years as banking services become more and more digitalized.

Third, financial authorities should also find ways to accelerate the development of the fintech industry in the country. Experience from other countries such as China suggests a solid performance of the industry will arguably also increase competition with the banking industry. At the moment there is virtually no competition between banks and fintech companies.


Finally, another constraint that both banks and fintech companies identify as restricting the use of fintech services is poor telecommunications infrastructure and internet connection, especially in regions outside Java. This hinders the provision of fintech services in those regions. It is one reason why most, if not all, of the fintech companies currently in operation are concentrated in Java. Recall that banks' operations are also concentrated primarily in Java and, to a lesser extent, in Sumatra. Relevant authorities should find ways to address this issue as it also hinders government efforts to increase financial inclusion.

A caveat is in order. Fintech is not a panacea. Financial authorities should also pay attention to the potential downsides of fintech. To do so they may want to take a closer look at fintech development in China, arguably one of the most developed in emerging markets. There have been scandals involving fintech companies in China, such as selling high-yield bonds online.



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# Appendix 1

## Econometric Models

The descriptions of the variables used in the models are as follows:

- Net Interest Margin (NIM) is a measure of the difference between the interest income generated by banks or other financial institutions and the amount of interest paid out to their lenders (for example deposits), relative to the amount of their (interest-earning) assets. NIM is used as a bank efficiency indicator and becomes the dependent variable in our econometrics model.
- The Lerner index is a measurement of market structures that specifically measures inefficiency resulting from the difference between price and marginal cost, which is a reflection of market imperfection. The Lerner index is ranged from 0 to 1. Value 0 in the Lerner index shows perfect competition conditions, while value 1 shows monopoly conditions. Mathematically, the Lerner index can be written as follows:


$$\text{Lerner Index} = \frac{(\text{Product Price} - \text{Marginal Cost})}{\text{Marginal Cost}}$$

Product Price in the model is calculated by operational income divided by total assets, while marginal cost is estimated from cost function. The estimated cost function is the cost function with one input and three input prices. Each cost function of an individual bank is estimated for each year with a fixed effects model. The cost function model can be written as:

$$\begin{aligned} \ln(TC)_{it} = & \alpha_0 + \alpha_j \sum_{j=1}^3 w_{it}^j + \sum_{j=1}^3 \sum_{k=1}^3 \alpha_{jk} \ln w_{it}^j w_{it}^k + \beta_1 \ln(Y_{it}) + \beta_1 \ln(Y_{it})^2 \\ & + \sum_{j=1}^3 \beta_{3j} \ln(Y_{it}) \ln(w_{it}^j) \\ & + \gamma_{1t} T + \gamma_{2t} T^2 + \sum_{j=1}^3 \gamma_{3t} T \ln(w_{it}^j) + \sum_{j=1}^3 \gamma_{4t} T \ln(Y_{it}) + \mu_i + u_{it} \end{aligned}$$

Where TC is operational expense, Y is total assets,  $w_1$  is labor expense per total asset,  $w_2$  is administration expense per total expense, while  $w_3$  is interest expense per total asset. Using the coefficient obtained from our cost function, we can calculate our MC function as follows:

$$\begin{aligned} \frac{\partial \ln(TC)}{\partial y} &= \frac{\partial (TC)}{\partial y} \frac{y}{TC} \\ \frac{\partial \ln(TC)}{\partial y} &= MC \frac{y}{TC} \\ MC &= \frac{\partial \ln(TC)}{\partial y} \frac{TC}{y} \end{aligned}$$

- 
- c) Level of risk aversion (risk averse) following the Maudos and Guevara (2004) approach, level of risk aversion is calculated by the ratio of total equity and total assets.
  - d) Quality management reflects the ability to manage assets efficiently. We calculate this by using operational expense divided by operational income.
  - e) Specialization is the specialty business of bank intermediation to reduce intermediation costs in the economies of scale. We classify specialization of banks into loans and deposits, and use a measure of total loans to total assets, and total deposits to total assets.
  - f) Opportunity to hold reserve is calculated by operational cost per total assets.
  - g) Credit risk is the risk used to capture the possibility of default normally charged on loan interest rates. It is calculated based on a non-performing loan (NPL) number.
  - h) Implicit interest is the variable to capture other expenses (administration expense) to interest expense on deposit.
  - i) Size of bank is proxied by natural log of total asset.
  - j) Dummy fintech is a dummy variable used to capture whether there is any impact from the development of fintech services which have grown over the past few years. We apply the variable from the year 2014 onwards.
  - k) Gross domestic product (GDP) growth is used as a macroeconomic indicator as a control variable. It is obtained from the World Development Indicators of the World Bank.
  - l) Inflation rate is used as a macroeconomic indicator as a control variable. It is calculated from the consumer price index (CPI) and obtained from the World Development Indicators of the World Bank.

**Table 11. Descriptive Statistics of Variables**

year	stats	nim	risk_averse2	lerner	quality_management	special1	special2	credit_risk	opportunity	implicit_interest	size	liquidity	roa	roe
2005	mean	7.59	0.09	0.71	83.62	52.52	74.09	4.58	8.52	47.12	14.61	73.63	2.56	15.82
2005	sd	4.21	0.11	0.10	28.22	19.39	15.91	7.66	2.72	52.79	1.89	35.19	2.70	13.00
2006	mean	7.05	0.09	0.72	82.05	50.79	73.97	4.17	9.54	31.47	14.81	71.14	2.54	15.96
2006	sd	3.11	0.13	0.07	20.30	18.76	16.04	5.82	3.23	25.89	1.88	37.47	2.19	15.84
2007	mean	7.07	0.11	0.73	82.08	52.28	71.71	4.20	8.08	33.34	15.05	72.41	2.54	15.65
2007	sd	3.08	0.13	0.06	20.41	17.92	16.61	5.81	2.41	21.20	1.81	37.82	2.20	16.08
2008	mean	6.78	0.12	0.74	79.69	59.11	69.17	2.64	8.50	39.04	15.20	89.18	2.46	13.82
2008	sd	2.72	0.14	0.07	20.18	17.47	18.65	2.70	2.88	36.87	1.83	45.29	2.23	13.34
2009	mean	6.61	0.11	0.71	80.88	57.65	69.80	3.17	10.20	55.33	15.34	83.65	2.34	12.31
2009	sd	2.63	0.14	0.09	28.62	17.61	18.37	4.62	5.44	119.67	1.81	35.79	2.81	21.14
2010	mean	6.69	0.11	0.72	80.60	58.93	70.18	2.77	9.87	54.51	15.55	89.69	2.26	14.93
2010	sd	3.31	0.14	0.07	21.38	15.21	17.15	5.05	9.30	44.34	1.79	39.95	2.48	16.70
2011	mean	6.21	0.09	0.72	80.11	60.15	70.51	1.91	8.72	47.30	15.80	87.44	2.27	13.99
2011	sd	2.82	0.11	0.06	17.03	12.63	17.21	1.66	4.06	30.94	1.78	34.12	1.89	13.04
2012	mean	5.94	0.08	0.72	78.78	63.76	70.09	1.83	8.48	51.00	15.99	99.74	2.24	15.94
2012	sd	2.84	0.09	0.05	13.84	12.27	16.78	1.65	4.38	56.85	1.75	60.37	1.35	12.32
2013	mean	5.95	0.08	0.72	79.63	66.86	68.65	1.63	8.63	56.55	16.18	102.00	2.23	14.71
2013	sd	2.86	0.10	0.05	14.03	10.70	16.54	1.39	3.81	108.90	1.73	46.22	1.42	11.27
2014	mean	5.77	0.08	0.71	83.01	66.01	69.33	2.33	9.38	53.18	16.39	100.09	1.90	11.02
2014	sd	3.53	0.08	0.05	14.90	10.03	17.09	2.07	4.02	134.60	1.65	44.68	1.50	10.27
2015	mean	5.67	0.08	0.69	88.63	66.61	68.20	3.09	11.47	39.91	16.51	102.27	1.18	8.05
2015	sd	3.44	0.09	0.07	19.87	10.25	16.84	3.88	7.56	40.04	1.61	48.39	2.75	14.17
2016	mean	5.86	0.09	0.68	89.37	65.15	67.24	3.43	11.10	47.31	16.60	104.60	1.28	7.11
2016	sd	3.63	0.12	0.09	26.04	10.16	16.09	4.71	6.85	58.61	1.59	61.15	2.74	16.46
2017	mean	5.63	0.09	0.70	86.79	62.61	66.77	3.94	10.59	47.14	16.70	97.10	1.51	6.85
2017	sd	3.59	0.10	0.08	22.05	12.41	17.25	9.70	8.17	39.66	1.57	41.30	2.31	14.61

Table 11 above presents the summary statistics of all variables used in this paper. The ratio of total equity per total asset which becomes the proxy of risk-averse behavior slowly decreases from 2009, and peaks at 13.4%. For the variable of market power, we use the Lerner index, which shows a relatively stable number, approximately 0.7 from 2005 to 2017. This indicates that the banking sector is a highly concentrated sector. In the given period, the banking sector in Indonesia is dominated by state-owned banks Bank Mandiri, BNI, and BRI, and one of the largest private banks, BCA.

Moreover, we look more closely at bank-specific characteristics such as quality management. The variable of quality management, which is calculated from the ratio of operational expense to operational income, represents banks' efficiency and has a reverse relationship with NIM. Quality management is shaped like a U-curve (by excluding 2008), where it reached its lowest point in 2012.

The ratio of total loans to total assets and ratio of total deposits to total assets are depicted as specialization variables. From 2005 to 2017, the values are shown to be quite stable. Credit risk, which is calculated by using NPL, has steadily shown low values except in 2011 and 2012. Meanwhile the size of banks has steadily increased from 2005 to 2017, which indicates an increase in total bank assets.



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