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The Impact of Financial Technology on Commercial Banks: A Case Study of China

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ABSTRACT

The aim of the research was to investigate the impact of financial technology on the financial performance of commercial banks. in China. Based on previous literature review and empirical evidence this study collects the annual financial data on local banks in China. A total of 23 commercial banks were used as sample of the study. The annual data ranges from 2011 to 2020. The data was analysed using GMM dynamic panel data model. Based on the analysis, the findings showed that financial technology has an overall positive impact on the return on asset of commercial banks.

Contribution/Originality: This study is helpful for the existing literature to study the basic principles of financial technology in the real economy from a macro perspective.

1. Introduction

Financial technology, often known as FinTech, is a burgeoning business model in the financial market that is propelled by emerging technologies such big data, blockchain, cloud computing, and artificial intelligence (Lai et al., 2020). The process encompasses the utilization and provision of novel products, among various other activities. Based on the findings presented in the research titled 'The Pulse of Fintech 2018' by Klynveld Peat Marwick Goerdeler (KPMG) International Limited, it is observed that the total global investment in FinTech enterprises amounted to $111.8 billion, encompassing a total of 2,196 transactions in the year 2018 (Potměšil, 2018). Based on the research, the global investment in fintech startups reached a total of $111.8 billion in the year 2018,

encompassing a total of 2,196 agreements (Potměšil, 2018). Based on the findings presented in the research, it can be inferred that financial technology has become a prominent presence within the contemporary financial industry. The ongoing advancement of financial technology has exerted a substantial influence on commercial firms and commercial banks, necessitating the adaptation of traditional institutions.

1.1. Research problem

The emergence of Financial Technology (FinTech) inside the banking sector has had a significant impact on various applications, leading to a transformative shift in the manner in which consumers may conveniently access and manage their financial information. The impact of blockchain technology extends to several sectors, including mobile payment services like Alipay, as well as investing and insurance organizations. The extensive influence of financial technology can also be perceived as a possible menace to traditional banks or commercial banks (Zhao et al., 2019). In the contemporary era of digitalization, customers exhibit a diminished inclination towards availing themselves of services offered by the conventional financial services sector. On the contrary, their preference lies in expeditious and secure service. The increasing popularity of fintech is attributed to its role in disrupting conventional banking and other traditional financial services.

The existing body of scholarly literature primarily centers on examining the influence of financial technology on the real economy. This research predominantly concentrates on investigating the micro-level mechanisms and effects of financial technology on various aspects such as financing activities, research and development innovation, and financial leverage within enterprises. Additionally, these studies aim to establish a comprehensive understanding of the relationship between financial technology and entity enterprises. While entity firms hold significance within the real economy, it is crucial to note that they do not encompass the entirety of the real economy (Meng, 2019). Hence, the current body of literature lacks comprehensive analysis of the impact of financial technology on the real economy at a macro level. Consequently, this research article aims to contribute to this area of study by providing valuable insights.

1.2. Objectives

Under the general trend of financial technology, how will the profitability of traditional financial banks change? Therefore, the main objective of this study is to examine the effect of financial technology on the financial performance of commercial banks. Specifically, this study would like to:

i. Examine the effect of financial technology index on return on asset of commercial banks.
ii. Investigate the effect of control variable (total deposit, total loan, bank stability index, GDP growth rate, CPI change rate and stock market transaction scale) on return on assets of commercial banks.

1.3. Research Hypothesis

Hypothesis 1: The vigorous development of financial technology will enhance the profitability of commercial banks.

Hypothesis 2: The strong development of financial technology will reduce the profitability of commercial banks.

1.4. Significant

The purpose of this study is to offer a comprehensive understanding of the relationship between financial technology and the actual economy, focusing on the research perspective, analysis framework, and empirical evidence. The relevance lies in its ability to offer theoretical advice and a foundation for the formulation of policies. The capacity to effectively cater to the financial needs of the real economy is a crucial assurance for ensuring the stability, robustness, and exceptional performance of the real economy. Currently, financial technology (fintech) is regarded as the strategic trajectory of the financial sector, demonstrating its efficacy in catering to the needs of financial consumers and fostering economic progress in practical applications. Hence, investigating the operational principles of financial technology in support of the real economy holds significant relevance for policymakers in offering theoretical direction. This endeavor not only facilitates policymakers in comprehending the crucial role of financial technology advancement in fortifying and enhancing the real economy, but also assists them in aligning their actions with practical requirements. Implementing targeted strategies to harness the potential of financial technology in facilitating the real economy, removing barriers to development, and attaining socio-economic objectives would contribute to harmonizing the general landscape and pace of economic progress across various areas and industries.

2. Literature Review

The impact of financial technology on the financial system is a well-established subject, with significant development being made in this field. The renowned theory of "creative destruction" proposed by Austrian economist Schumpeter in 1921, posits that novel products and services have the capacity to not only establish fresh markets and engender novel values but also exert an influence on prevailing markets and dismantle established values. The phenomenon of financial technology's influence on the established financial system might be aptly characterized as "creative destruction". From an optimistic perspective, the advancement of financial technology serves to facilitate the modernization of conventional financial institutions, thereby augmenting their overall capabilities and competitive edge. Financial technology (fintech) has been criticized for disrupting the equilibrium of the conventional financial system and exerting influence on the traditional financial industry and banking sector. However, it has also introduced novel financial dangers (Luo, 2020).

Fintech is a portmanteau of the terms "financial technology" and "financial services." The phrase encompasses various technologies employed to enhance, optimize, digitalize, or perturb conventional financial services. According to Varga (2017) fintech refers to the software, algorithms, and apps that are utilized in conjunction with computer- and mobile-based tools. Additionally, this category may encompass hardware components, such as interconnected smart piggy banks or virtual reality (VR) trading platforms. Fintech platforms facilitate several ordinary financial activities, including check depositing, inter-account money transfers, bill payment, and the submission of financial aid applications. Furthermore, the aforementioned concepts encompass intricate technical aspects, namely peer-to-peer lending and cryptocurrency exchanges (Lee, 2017).

2.1. Return on asset (ROA)

Regarding the use of profit indicators for commercial banks, the majority of researchers commonly utilize return on total assets (ROA) and return on equity (ROE) as the primary measuring metrics. Based on the calculation guidelines stipulated by the China Securities Regulatory Commission, the alteration in return on total assets serves as an indicator of the corresponding variation in return on net assets. Therefore, the Return on Assets (ROA) is employed as the dependent variable to assess the profitability of commercial banks within the context of this research. The Return on Assets (ROA) is a metric that measures the efficiency of generating net profit in relation to the total assets employed. This study draws upon the relevant research conducted by Diao et al. (2017), focusing specifically on the total assets of banks. The rate of return (ROA) serves as a metric for evaluating the profitability of commercial banks. The dependent variable chosen for this study is the Return on Assets (ROA) of commercial banks.

2.2. Financial Technology Index

This study chooses the level of financial technology development as the independent variable. This study utilizes the research methods employed by Shen and Guo (2015) to construct a financial technology index for China. The lack of authoritative data that accurately represents the extent of financial technology, coupled with the macroscopic nature of financial technology data, necessitates the adoption of these methods. The index is constructed by leveraging the Baidu index database and employing text mining techniques.

Firstly, it is necessary to identify the key terms associated with financial technology in conjunction with the present state of its development. This study categorizes financial technology into two distinct components, namely fundamental technology and application scenarios. The areas of basic technology encompass big data technology, artificial intelligence technology, distributed technology, Internet technology, and security technology. The application scenario can be categorized into four distinct parts: payment and settlement, deposit, loan and capital raising, and investment management. It is worth noting that market facilities often encompass the underlying technology and may overlap with these aforementioned areas. The categorization presented in this study is derived from the segmentation of the financial technology business model as outlined by the Basel Committee, as documented by Li et al. (2020). This technology is employed for the purpose of substituting network channels in the context of banking.

Once the keyword dimension has been established, it is imperative to carefully evaluate the most pertinent and illustrative terms within each dimension. Subsequently, a judicious selection of five keywords per dimension must be made. Once the keyword has been identified, each selected keyword is searched using the Baidu index database spanning from 2011 to 2020. The annual index of Baidu keywords is subsequently derived by factor analysis using Stata and SPSS software, resulting in the synthesis of China's financial technology index. The rationale for selecting Baidu Index warrants elucidation. The prominence of the Baidu search engine in China can be compared to that of the Google search engine in Europe and the United States. The Baidu search engine is widely utilized by individuals in China as their primary choice for conducting online searches. It has the capacity to accurately depict the prevailing social structure.

2.3. The impact of Financial Technology on the status of Commercial Banks

There is much discussion about the impact of Internet finance on the status of commercial banks, particularly regarding their asset-liability and intermediary businesses, which accelerates financial disintermediation. According to Xie (2019), FinTech has a significant impact on the intermediary business of commercial banks, as well as on their assets and liabilities. This impact is mainly reflected in the third-party payment and mobile payment services provided by FinTech, which greatly reduces costs (Tanda & Schena, 2019). These services rely on cloud computing and other technologies to efficiently store and calculate customer data and information, thus effectively alleviating information asymmetry. Additionally, these services provide more convenient and efficient payment and settlement options that can be accessed anytime, anywhere, and in any way. Wang (2019) suggests that FinTech has impacted the traditional business of banks and accelerated the process of interest rate and intensified price competition among commercial banks. Meanwhile, He and Rui (2020) use the example of Bao in Alipay to analyze its impact on the business operations of traditional commercial banks. Compared to commercial banks, Bao has lower operating costs and provides more convenient and faster services.

Ultimately, the traditional capital and liability businesses of commercial banks are not immune to the impact, and FinTech is accelerating the trend of financial disintermediation in numerous ways. Moreover, FinTech is affecting the customer base and market competition of commercial banks. Therefore, the future development of commercial banks must be closely linked with FinTech to create a "new type of bank" that combines professional, immediate, and universal benefits, namely, intelligent, mobile value and information integrators.

According to Meng (2019), FinTech has reduced the operating costs of commercial banks, expanded the scope of their services, and improved their ability to meet customer needs. Zhou (2021) suggests that FinTech brings many opportunities to commercial banks, including expanding their customer base and extending their business chain, optimizing service experience and enhancing user stickiness, enhancing technical strength and changing operational modes, integrating trading channels and building a pluralistic system, and unlocking the potential of data to strengthen the level of risk control.

3. Research Method

This study selects these 23 commercial banks as the object of study, because most of these banks are listed before 2011, with complete information and strong representativeness. The study included control variables and mentioned below:

i. Commercial banks‘ total deposits (CK)
ii. total loans (DK)
iii. Bank Stability Index (BSI)
iv. GDP growth rate
v. CPI growth rate and Stock market transaction scale (STOCK) are selected as the control variables.

The return on asset (ROA) is a measure of the profitability of commercial banks. This study selects the ROA of commercial banks as the dependent variable. This study selected the data from 2011 to 2020 and chose five state-owned banks, eighty joint-

stock commercial banks , ten city banks in China. The commercial banks' return on asset (ROA) was treaded as the dependent variable while the financial technology index Fintech) was the independent variable.

The construction steps are as follows: Firstly, the original Fintech index lexicon is constructed from five aspects: payment and settlement, resource allocation, asset management, information channels and innovative technology. As shown in Table 1, it shows the five key words selected by the researcher when establishing the financial technology index, and then selects more detailed keywords from the five key words for classification.

Table 1: Keywords

Dimension	Keyword
Payment and settlement	Digital currency, Network connection , Internet of Things, NFC payment, third-party payment, equity crowdfunding, Internet finance, open banking, mobile payment.
Resource allocation	Cyber-physical systems, virtual reality, mobile internet, billion-level concurrency, blockchain, big data
Asset management	Quantitative finance, converged architecture, business intelligence, identity verification, biometric technology, data visualization, data mining, investment decision support system, intelligent investment.
Information channels	Image calculation, image understanding, text mining, credit reporting, intelligent financial contract, intelligent customer service, intelligent data analysis, cloud computing.
Innovative technology	EB level storage, differential privacy technology, multi-party secure computing, distributed computing, machine learning, Neuromorphic Computing, stream computing, green computing, memory computing, artificial intelligence, cognitive computing, deep learning, heterogeneous data, semantic search, speech recognition, natural language processing.

Secondly, according to the research of Askitas and Zimmermann (2009), it is considered that the number of annual news reflects people's attention to something and the demand for related information. Therefore, based on Baidu database, the number of 48 annual news keywords in thesaurus is searched. The operation is as follows: count the number of annual news corresponding to 48 keywords in the thesaurus from 2010 to 2020.

Then, factor analysis is carried out on the keywords in the original thesaurus, and the cognitive index of synthetic financial technology is calculated. The first step is to test whether the variables can be factor analyzed. KMO test and Bartlett sphere test are mainly used here, and the results are shown in Table 2. From the results in Table 2, the KMO value is 0.795, which is much larger than the critical value of 0.5, so it can be explained that the data in this paper can be regressed by principal component analysis.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.795
Bartlett's Test of Sphericity	Approx. Chi-Square	4190.747
	df	1128
	Sig,	.000

As shown in Table 3, it shows all the variables selected by this researcher, and shows which articles in the past research have chosen the same variables as this author.

Table 3: Variables design

Variable type	Variable name	Symbol	Previous studies
Dependent variables	Return on asset	ROA	Yu, Zhou, & Huo (2020)
Independent variable	Financial technology index	FINTECH	Chu & Guo (2014)
Control variables	Total deposits	CK	Luo (2020)
	Total loan	DK	
	Bank stability index	BSI	
	GDP growth rate	GDP	Yu (2020)
	CPI change rate(1978=100)	CPI	
	Stock market transaction scale	STOCK	

3.1. Model building

This study incorporates the square term of the financial technology index as an additional explanatory variable in the empirical analysis. This square term is used to represent the anticipated future development level of financial technology. The study then proceeds to compare this future development level with the current development level of financial technology, which is represented by the core explanatory variable, the financial technology index. The purpose of this comparison is to test the validity of Hypothesis 1 and Hypothesis 2, as proposed in the study.

It is widely acknowledged that the majority of banks exhibit robust continuity in their business operations, particularly in terms of profitability. The correlation between the two consecutive years exhibits a significant level of association, rendering the static panel data model unsuitable for estimation purposes. Hence, this study employs the GMM dynamic panel data model to estimate the complete dataset. Additionally, separate estimations are conducted for the sub-samples of joint-stock banks and city commercial banks. This approach addresses the issue of correlation between independent variables and random disturbance terms arising from the inclusion of lagged dependent variables as independent variables. By doing vertical deviation processing on the data, it has been ascertained that the model tool variables consist of the second-order lag of the rate of return on total assets, as well as the first-order lag of both the financial technology index and its square term. The design model can be described as follows:

$$ROA_{it} = a_0 + a_1 ROA_{i,t-1} + a_2 FINTECH_{it} + a_3 FINTECH_{it}^{\ 2} + a_4 LnCK_{it} + a_5 LnDK_{it} + a_6 BSI_{it} + a_7 GDP_{it} + a_8 LnCPI_{it} + a_9 LnSTOCK_{it} + \varepsilon_{it}$$

In the above formula, “i” represents the sample commercial bank and “t” represents the sample year, ROA_{it} represents the rate of return on the bank's total asset, $FINTECH_{it}$ and $FINTECH_{it}^{\ 2}$ respectively represent the fintech index and its square terms, $LnCK_{it}$ and $LnDK_{it}$ respectively represent the logarithm of total bank deposits and loans, BIS_{it} represents the bank stability index, GDP_{it} represents the growth rate of GDP,

$LnCPI_{it}$ represents logarithm of price index, $LnSTOCK_{it}$Indicates the logarithm of the turnover in the stock market, $ROA_{i,t-1}$ represents the first-order lag term of ROA_{it}, and ε_{it} represents the random disturbance term. Deposits, total loans, and stock market turnover underwent logarithmic processing, and CPI was based on 1978 and underwent logarithmic processing as well. The purpose of this was to eliminate heteroscedasticity.

4. Results

Firstly, the statistical data of the independent variable, Financial Technology Index (FINTECH) and the dependent variable Return on asset (ROA) and six control variables Total deposits, Total loan, Bank stability index, GDP growth rate, CPI change rate, Stock market transaction scale (CK, DK, BSI, DGDP, CPI, STOCK) in 2010-2018 are analyzed by Stata software.

The deposit and loan scales of all commercial banks generally remain in a stable position, which is in line with their status as the core business of the banking industry. Table 4 is a descriptive statistic of banks, according to the table we can know that the point of view of maximum, average and standard deviation, the deposit and loan scales of all commercial banks are above the basic horizontal line, while the deposit and loan scales of all kinds of banks are still heterogeneous. Due to the great differences in various businesses within banks, the stability indexes of banks have certain differences, the growth rate of GDP has decreased year by year, and the price index and the turnover of the stock market have remained relatively stable.

Table 4: Descriptive Statistics of Banks

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	230	1.018	.223	.12	1.499
FI	230	0	.189	-.616	.444
FI2	230	.036	.056	0	.379
LNCK	230	28.16	1.332	25.627	30.845
LNDK	230	27.858	1.413	25.113	30.555
BSI	230	52.035	11.2	33.599	101.592
DGDP	230	.068	.018	.022	.096
LNCPI	230	4.63	.011	4.62	4.66
LNSTOCK	230	13.723	.649	12.66	14.75

4.1. The influence of fintech on the overall profit of China's commercial banks

GMM dynamic panel regression is performed on the total data of all sample commercial banks. Based on the analysis of Table 5, it is evident that there exists a statistically significant positive relationship between the financial technology index and the return on total assets of commercial banks, when considering the entire sample. This finding suggests that the implementation of financial technology has positively impacted the profitability of Chinese commercial banks, thereby supporting the hypothesis 1 as posited. Simultaneously, upon examining the quadratic component of the financial technology index, a notable inverse relationship is discovered with the return on total assets of commercial banks. This finding suggests that as financial technology continues to advance, the absence of effective measures to address its development may adversely affect the profitability of commercial banks in China. This outcome aligns with the supposition put forth in hypothesis 2.

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Table 5: Empirical results of the impact of fintech on the overall profitability of commercial banks (TWO-STEP SYSTEM GMM)

VARIABLES	(1) ROA
Financial technology index （FI）	0.135***
	(3.822)
Square term of financial technology index (FI^2)	-0.270***
	(-3.259)
Total deposits (LNCK)	0.734***
	(7.258)
Total loan (LNDK)	-0.659***
	(-7.184)
Bank stability index (BSI)	0.00406***
	(5.533)
GDP growth rate (DGDP)	1.870***
	(8.033)
CPI change rate (LNCPI)	-0.363*
	(-1.878)
Stock market transaction scale （LNSTOCK）	-0.104***
	(-13.54)
Return on asset(ROA_{-1})	0.857***
	(0.023)
Constant	1.477
	(1.223)
Observations	230
Number of idd	23
ar2p	0.150
hansenp	0.998
ar1p	0.0211

z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From the standpoint of control variables, it can be shown that the correlation coefficient of deposits has a positive relationship, indicating that they have the potential to enhance bank profitability. The loan exhibits a negative trend, and empirical evidence suggests a high coefficient of deposit, indicating that deposit business plays a central role in generating profits for commercial banks in China. Additionally, there is a positive correlation between bank stability and profitability, suggesting that stability can also contribute to a bank's financial gains. However, it is important to note that risks and benefits are closely intertwined in this context. The rewards that a bank can gain are inversely proportional to the level of risk it assumes. The weakest correlation coefficient of bank stability in the table provides a further perspective on this issue. There exists a positive correlation between the growth rate of Gross Domestic Product (GDP) and profitability. Conversely, a negative correlation is shown between stock turnover and the Consumer Price Index (CPI).

5. Conclusions

The rapid advancement of financial technology (fintech) has been observed to have dual effects on the profitability of commercial banks: a positive influence known as the "technology spillover effect" and a negative effect referred to as the "competition effect." This study employs data from a sample of 23 Chinese commercial banks spanning the period from 2011 to 2020 in order to examine the impact of financial technology on the profitability of these banks.

Based on empirical investigation, the investigator discovered. The magnitude of the positive influence exceeds that of the negative impact. Liu (2020) identified a comparable trend. Empirical research demonstrates that financial technology indicators have a positive impact on the return on net assets of commercial banks. This suggests that financial technology has the potential to enhance the profitability of commercial banks. The impact of financial technology on the profitability of commercial banks becomes increasingly evident as they engage in research and development activities. Commercial banks should strategically leverage the advancements in financial technology, allocate increased resources towards it, actively pursue its development, and undertake transformative measures to foster growth. The absence of effective countermeasures to address financial technology can potentially result in adverse consequences. It is imperative for commercial banks to remain abreast of prevailing trends, effectively manage both the advantageous and detrimental consequences of financial technology, and for regulators to enhance their supervision.

Future research can broaden the research scope, objects and categories, bank types, indications, and time range when time, people, and material resources allowed. Financial technology index development can be made more methodical to reduce errors. Financial technology's impact on society isn't limited to China's commercial banks, therefore researchers can select banks from other countries as samples.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti of Malaysia Sabah (UMS).

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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