CHAPTER 21

FINANCIAL TECHNOLOGY AND BANK RISK: A CROSS COUNTRY STUDY

Nugroho Saputro, Ariyanto Adhi Nugroho and Irwan Trinugroho

ABSTRACT

Financial technology has been growing significantly over the last few years all around the world. In this chapter, we study the impact of financial technology on the risk and performance of commercial banks as the incumbent in the industry. The authors combine a cross-country dataset resulting in 336 country-year observations. The authors find that financial technology, more particular the growing of adoption in mobile money, has been considered to increase the risk of banks. However, the authors do not find any evidence that the performance of commercial banks has significantly eroded by the presence of financial technology.

Keywords: Fintech; banking; risk; performance; mobile money; cross country

1. INTRODUCTION

Over the last decade, the advanced technology has facilitated massive financial innovations reflected in some forms such as financial technology (fintech) lending, fintech payment, digital banking, cryptocurrencies (blockchain) and robo advisor (Milian, Spinola, & de Carvalho, 2019; Thakor, 2019). The massive innovations are expected to bolster the access to finance to reach inclusive finance and eventually inclusive economic.

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On the root of hysteria, however, there is a potential dark side of the technological-based financial innovations. Such an amazing growth of the financial technology could be considered to treat the existing financial intermediary institutions due to the increased density in the financial industry. Jagtiani and John (2018) mention that potential disruption is in place to weaken the existence of incumbents in financial industries. Some studies have also considered the sustainability of traditional banking due to the raising of financial technology more particular the online direct lending (e.g., Lee & Shin, 2018). It is due to the fact that fintech lending has more flexibility in the process and mechanism in channeling loans and paying the installment by eliminating some intermediary processes normally happen in the traditional banking system. It is due to the benefit from internet-based information processing (Milne & Parboteeah, 2016). Therefore, the presence of fintech lending has to some extent irritated the incumbency of formal financial institutions, with particular emphasizes on small-scale banking due the size of loans of online direct lending is typically small.

Santoso, Trinugroho, and Risfandy (2020) provide evidence that over the recent years, the growing of outstanding loans by fintech lending, more particular in Indonesia, is also driven by the existence of the regulation on fintech lending. It enhances the confidence of the potential borrowers and lenders to engage in this particular business. Similarly, Buchak, Matvos, Piskorski, and Seru (2018) conclude that two forces, regulatory differences and technological advantages, contribute in the growing of financial technology.

However, although this online direct lending could eliminate the intermediation cost in the formal financial institutions, it is still generally argued that fintech lending would have high loan rate due to the information asymmetric between lenders and borrowers. Therefore, the process of deflation of commercial banks' market share may take sometimes.

Threats to the banking industry is not only coming from the fintech lending, but also from the fintech payment, more particular the mobile money provided by non-bank newly established financial institutions. For instance, the experience in a few developing countries, notably in East Africa on the success of the MPesa m-payments platform, has demonstrated that to some extent this innovation reduces the roles of banking in the payment system (Iman, 2018). Junger and Mietzner (2019) find that shifting from banking services to fintech is common for households which have higher trust and comfort with new technologies, financial literacy, and overall transparency.

This chapter attempts to empirically investigate the impact of the presence of financial technology on the risk and performance of commercial banks all around the world. Riskiness of commercial banks may be affected due to the increased density in the industry could lead the incumbents to take more risks. Second, we also argue here that financial technology has eroded the market of commercial banks which subsequently decrease their performance. We test our research questions using a recent global dataset which covers the period of 2014–2017.

To the best of our knowledge, this study is the first to empirically estimate the direct effect of the growing of financial technology on the risk and performance of commercial banks. We find that commercial banks become riskier with the increase adoption of financial technology, however, our empirical results do not provide any evidence that performance of commercial banks decreases with the growing financial technology.

2. RESEARCH METHODS

Data

We collect the dataset from the World Bank and IMF database of the Financial Inclusion. The data covers 59 countries during the period of 2014–2017 resulting in 336 country-year observations. Table 1 presents the definition of all variables used in this study. Bank risk is proxied by the aggregate value of bank non-performing loans (NPL) to total gross loans for each country, while bank performance is reflected in three measures country-level of bank capital to assets ratio (CAPA), commercial bank branches (per 100,000 adults) per country (BRANCH) and country-level bank liquid reserves to bank assets ratio (LIQU). Our main explanatory variable which is the growing of financial technology is proxied by number of adults who have mobile money account to population (MMA). We take into account a number of control variables at the country-level including GDP growth, population, internet users, employment, ratio of female workers, foreign direct investment, government spending for education, and income class.

Table 1. Variable Definitions.

Variable Definitions	
NPL	The aggregate value of bank non-performing loans to total gross loans for each country (%)
CAPA	Country-level of bank capital to assets ratio (%)
Branch	Commercial bank branches (per 100,000 adults) per country
LIQU	Country-level bank liquid reserves to bank assets ratio (%)
MMA	Number of adults who have mobile money account to population (%)
GDPGrowth	Annual gross domestic product growth (%)
Pop	Number of populations for each country
HDI	Country-level Human Development Index
Internet_user	Individuals using the internet (% of population)
Cost_Startup	Cost of business start-up procedures (% of GNI per capita)
Empoyment	Employment to population ratio, 15+, total (%) (modeled ILO estimate)
Female	Ratio of female to male labor force participation rate (%) (modeled ILO estimate)
FDI	Foreign direct investment, net inflows (% of GDP)
Gov_Edu	Government expenditure on education, total (% of GDP)
dum_female	dummy variable, equal to 1 if the country female labor is more than 51%, 0 otherwise
dum_tech	dummy variable, value 1 if the percentage of the country's high-technology exports over manufactured exports is more than 51%, 0 if otherwise
Income_class	dummy variable, 1 indicates that the country's income class is either high income or upper-middle class, 0 otherwise

3. EMPIRICAL RESULTS

Descriptive Statistics

Table 2 exhibits the descriptive statistics of variables. Observed countries appear to have relatively high credit risk (NPL) in average, that is, 5.65% with standard deviation value of 4.77. The lowest credit risk in our observation is at 0.75% and the highest is at 25.81% that is terribly risky. In terms of capital adequacy (CAPA), our observed countries are still in good condition where the average is 10.89%. Country with maximum CAPA has 17.77% while the minimum value in our observation is 5.43% that is not adequate. Commercial banks' branches per 100,000 adults show average value of 11.78. Banks' country-level liquidity of our observations is not really ideal in average, with only 21.21%. The maximum is 97.84% while the minimum is 1.52%.

We discover that adult mobile money user from fintech lending (MMA) is averaging at 9.56% of total country population. The highest country with 72.93% is mobile user. Average internet user in these countries reaches 34.03% of the population. As for the cost of business start-up procedures, the average is 35% of GNI per capita, with minimum value at 0.2% and maximum value at 351.6%.

Further, we examine the profile of observed countries where the average GDP growth is 3.86% with minimum value at −20.59% and maximum value at 13.57%. Average foreign direct investment is 4.23% to GDP, showing −37.15% at minimum and 50.01 at maximum. Average population of our samples is 51,200,000, the lowest is at 1,300,000 while the most populated is 1,300,000,000. Average female to male ratio is 69.52%, with maximum value of 16.61% and maximum value at 103.79%. Average Human Development Index is at 0.63, the lowest is at 0.34 at the top at 0.92. Employment ratio averages at 59.99%, with maximum value at 86.07% and minimum value at 33.34%. Lastly, average government spending on education is 4.25% of GDP, the highest reach 7.53% and the lowest is at 1.469%.

Table 2. Descriptive Statistics.

	Obs.	Mean	SD	Min.	Max.
NPL	224	5.659133	4.773677	0.756533	25.8102
CAPA	217	10.88998	2.774658	5.43362	17.771
Branch	289	11.78315	10.08925	0.794465	71.6071
LIQU	285	21.21521	16.04277	1.52577	97.8489
MMA	336	9.562468	12.85338	0	72.93169
zDPGrowth	329	3.860472	3.067195	−20.5988	13.5722
Pop	336	51,200,000	146,000,000	1,300,000	1,300,000,000
HDI	332	0.6345422	0.134079	0.345	0.932
Internet_user	336	34.03697	22.37486	1.24868	94.8199
Cost_Startup	335	35.04537	43.32677	0.2	351.6
Empoyment	336	59.99997	12.43489	33.34	86.077
Female	336	69.52064	21.17754	16.6127	103.79
FDI	333	4.234878	5.839723	−37.1548	50.018
Gov_Edu	180	4.25902	1.338355	1.46951	7.53068
Mobile_subs	336	100.5865	34.39726	31.3146	214.735
dum_tech	336	0.6934524	4617475	0	1
dum_female	336	0.8095238	0.3932624	0	1

In this study, we also categorize countries with high technology, countries with female-dominated population and income class using dummy variable. Our samples are 69% high-technology advanced countries and 80% female-dominated country.

Regression Results

Table 3 provides the regression results of the empirical model. The first column is for bank risk, while columns 2–4 are for bank performance. The main explanatory variable is the growing of fintech which is symbolized by MMA. Our results show that the growing of mobile money adoption is positively associated with the commercial banks' NPL which means that the higher the adoption of fintech

Table 3. Regression Result Model 1.

	(1)	(2)	(3)	(4)
	npl	branch	capa	liqu
Mma	0.0852***	−0.0515	0.00837	0.0744
	(3.18)	(−1.40)	(0.53)	(0.71)
gdpgrowth	−0.0348	−0.146	0.0218	0.511
	(−0.14)	(−0.87)	(0.40)	(1.46)
Lnpop	−0.152	−1.997*	−0.133	−1.466
	(−0.28)	(−1.76)	(-0.29)	(−1.10)
Hdi	−27.52**	60.90***	−9.325*	0.569
	(−2.03)	(3.25)	(−1.74)	(0.02)
Internet_user	0.0734*	−0.101	0.0378*	−0.0209
	(1.72)	(−1.49)	(1.72)	(−0.27)
cost_startup	−0.0282	−0.00899	0.00511	0.166***
	(−0.91)	(−0.57)	(0.82)	(3.64)
employment	−0.0492	−0.0533	0.0104	−0.00268
	(−0.48)	(−0.55)	(0.19)	(−0.02)
female	−0.000576	0.00519	0.0267	−0.184
	(−0.01)	(0.07)	(0.77)	(−0.79)
Fdi	0.0559	−0.121*	0.0609**	−0.116
	(1.61)	(−1.84)	(2.22)	(−0.52)
gov_spending_edu	−0.673**	−0.340	0.494**	−1.826**
	(−2.01)	(−0.96)	(2.42)	(−2.13)
mobile_subs	0.00251	−0.0301	0.00577	0.0348
	(0.09)	(−0.62)	(0.43)	(0.71)
dum_tech	0.845	2.403*	−0.606**	2.318
	(1.12)	(1.79)	(−2.16)	(1.05)
dum_female	0.874	−3.383	0.0897	8.216
	(0.44)	(−0.85)	(0.06)	(1.00)
_cons	27.79**	20.87	12.74	45.68
	(2.07)	(1.19)	(1.30)	(1.63)
N	119	159	120	157
N_g	41	59	42	56
r2_b	0.224	0.481	0.131	0.145
r2_w	0.258	0.106	0.230	0.251

t-statistics within parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Regression Result Model 2.

	(1)	(2)	(3)	(4)
	npl	branch	capa	liqu
Mma	0.0695***	−0.0726	−0.00194	0.111
	(2.58)	(−1.24)	(−0.10)	(1.08)
gdpgrowth	−0.0298	−0.147	0.0248	0.483
	(−0.12)	(−0.87)	(0.46)	(1.42)
Lnpop	−0.133	−1.953*	−0.123	−1.506
	(−0.24)	(−1.70)	(−0.27)	(−1.11)
Hdi	−27.52**	61.27***	−9.605*	1.754
	(−2.01)	(3.27)	(−1.76)	(0.07)
internetuser	0.0752*	−0.103	0.0400*	−0.0275
	(1.74)	(−1.54)	(1.75)	(−0.35)
cost_startup	−0.0270	−0.00938	0.00555	0.166***
	(−0.87)	(−0.60)	(0.87)	(3.66)
employment	−0.0514	−0.0540	0.00893	−0.00740
	(−0.50)	(−0.56)	(0.16)	(−0.04)
female	0.00232	0.00883	0.0276	−0.186
	(0.04)	(0.12)	(0.79)	(−0.79)
Fdi	0.0516	−0.121*	0.0585**	−0.109
	(1.47)	(−1.82)	(2.35)	(−0.50)
gov_spending_edu	−0.655*	−0.321	0.503**	−1.873**
	(−1.94)	(−0.92)	(2.40)	(−2.16)
mobile_subs	0.00218	−0.0298	0.00521	0.0317
	(0.07)	(−0.61)	(0.39)	(0.64)
dum_tech	0.539	2.163	−0.791***	2.889
	(0.57)	(1.59)	(−3.16)	(0.97)
dum_female	0.772	−3.511	0.0562	8.431
	(0.38)	(−0.88)	(0.04)	(1.01)
Mma*dum_tech	0.0180	0.0271	0.0109	−0.0448
	(1.01)	(0.53)	(1.20)	(−0.63)
_cons	27.61**	19.96	12.92	46.17
	(2.03)	(1.12)	(1.30)	(1.64)
N	119	159	120	157
N_g	41	59	42	56
r2_b	0.224	0.481	0.122	0.143
r2_w	0.261	0.108	0.241	0.256

t-statistics in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

in a country, the higher the commercial bank risk in this country. When we turn to bank performance, we find no significant effect of mobile money adoption on bank capital, bank branches, and bank liquidity.

In the Table 4, we interact between mobile money adoption and the country characteristics in term of high-technology exports (DUM_TECH). We argue here that the impact of financial technology on bank risk and bank performance will be stronger in the countries with high tech exports. However, we do not find significant evidence. We provide the results of robustness test in Table 5 by including income class in the model. In Table 6, we interact between mobile money

Table 5. Robustness Test Model 1: Include income_class.

	(1)	(2)	(3)	(4)
	npl	branch	capa	liqu
Mma	0.0765***	−0.0691	0.00908	0.0665
	(2.72)	(−1.60)	(0.61)	(0.65)
gdpgrowth	−0.0420	−0.145	0.0145	0.488
	(−0.17)	(−0.85)	(0.27)	(1.40)
lnpop	−0.184	−1.982*	−0.122	−1.389
	(−0.35)	(−1.84)	(−0.28)	(−1.06)
hdi	−27.08**	74.57**	−6.344	10.77
	(−2.05)	(2.17)	(−1.05)	(0.45)
internetuser	0.0817*	−0.0820*	0.0368*	−0.00666
	(1.78)	(−1.72)	(1.69)	(−0.09)
cost_startup	−0.0333	−0.00990	0.00534	0.166***
	(−1.05)	(−0.61)	(0.85)	(3.69)
employment	−0.0568	−0.0852	0.00448	−0.0254
	(−0.56)	(−0.67)	(0.08)	(−0.15)
female	0.00469	0.0278	0.0335	−0.166
	(0.09)	(0.29)	(1.00)	(−0.71)
fdi	0.0554	−0.123*	0.0586**	−0.116
	(1.56)	(−1.93)	(2.17)	(−0.51)
gov_spending_edu	−0.674**	−0.392	0.494**	−1.850**
	(−2.08)	(−1.02)	(2.40)	(−2.19)
mobile_subs	−0.00536	−0.0379	0.00518	0.0312
	(−0.19)	(−0.71)	(0.39)	(0.63)
dum_tech	0.836	2.472*	−0.611**	2.343
	(1.09)	(1.79)	(−2.13)	(1.06)
dum_female	0.795	−3.715	−0.171	8.205
	(0.42)	(−0.85)	(−0.12)	(0.99)
income_class	−0.402	−5.375	−0.723	−4.011**
	(−0.37)	(−0.71)	(−1.46)	(−2.08)
_cons	29.20**	15.30	11.18	39.87
	(2.25)	(0.91)	(1.17)	(1.41)
N	119	159	120	157
N_g	41	59	42	56
r2_b	0.275	0.497	0.143	0.161
r2_w	0.229	0.108	0.233	0.249

t-Statistics in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

adoption and a dummy variable to reflect high-income class country. We find negative and significant coefficient for bank risk which means that the effect of financial technology on bank risk is stronger in the country with higher proportion of high-income class.

4. CONCLUSION

As we have witnesses, financial technology has been growing significantly over the last few years all around the world to challenge the incumbency of traditional

Table 6. Regression Result Model 2: Include income_class*mma.

	(1)	(2)	(3)	(4)
	npl	branch	capa	liqu
mma	0.118***	−0.0750	0.000571	0.0734
	(4.59)	(−1.40)	(0.04)	(0.63)
gdpgrowth	−0.0679	−0.155	0.0205	0.484
	(−0.29)	(−0.87)	(0.39)	(1.35)
lnpop	−0.355	−1.964*	−0.0683	−1.414
	(−0.70)	(−1.85)	(−0.16)	(−1.10)
hdi	−41.39***	75.53**	−2.628	8.989
	(−2.65)	(2.12)	(−0.41)	(0.35)
internetuser	0.120**	−0.0896	0.0249	0.000416
	(2.49)	(−1.60)	(1.23)	(0.00)
cost_startup	−0.0223	−0.0106	0.00307	0.167***
	(−0.77)	(−0.66)	(0.45)	(3.69)
employment	−0.0527	−0.0856	0.00620	−0.0235
	(−0.55)	(−0.66)	(0.11)	(−0.14)
female	−0.0271	0.0274	0.0406	−0.169
	(−0.57)	(0.29)	(1.18)	(−0.71)
fdi	0.0535	−0.124*	0.0591**	−0.115
	(1.58)	(−1.91)	(2.20)	(−0.50)
gov_spending_edu	−0.480	−0.428	0.443*	−1.817**
	(−1.58)	(−0.98)	(1.96)	(−2.02)
mobile_subs	0.00156	−0.0375	0.00541	0.0308
	(0.06)	(−0.71)	(0.41)	(0.63)
dum_tech	0.740	2.463*	−0.577**	2.318
	(1.07)	(1.81)	(−2.16)	(1.03)
dum_female	1.581	−3.618	−0.353	8.244
	(0.76)	(−0.82)	(−0.25)	(0.98)
income_class	2.493**	−5.590	−1.392**	−3.393
	(2.16)	(−0.71)	(−2.13)	(−1.22)
Mma*income_class	−0.246***	0.0393	0.0551	−0.0614
	(−3.61)	(0.44)	(1.51)	(-0.33)
_cons	38.64***	14.86	8.264	40.88
	(2.67)	(0.89)	(0.90)	(1.46)
N	119	159	120	157
N_g	41	59	42	56
r2_b	0.297	0.497	0.109	0.160
r2_w	0.307	0.109	0.269	0.250

t-Statistics in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

financial institutions. In this chapter, therefore, we study the impact of financial technology on the risk and performance of commercial banks as the incumbent in the industry. We combine a cross-country dataset resulting in 336 country-year observations. We find that financial technology, more particular the growing of adoption in mobile money in a country, has been considered to increase the risk of banks. However, we do not find any evidence that the performance of commercial banks have significantly eroded by the presence of financial technology.

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