Research on the Impact of Banking Financial Innovation on Operational Risk

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ABSTRACT. *Commercial banks are the core of the financial system, and their risk-bearing capacity is an important guarantee to prevent and resolve systemic financial risks. Taking the Shanghai and Shenzhen A-share listed commercial banks from 2007 to 2018 as a sample, the intermediary effect analysis method is used to empirically study the relationship between commercial bank financial innovation, capital buffers and risk-taking. Research findings: 1.Financial innovation reduces the capital buffer of commercial banks and increases the risk-taking of commercial banks. 2.The capital buffer plays a significant intermediary role in the impact of financial innovation on commercial banks' risk-taking. 3.The governance of the professional committees in the board of directors plays a role in regulating the intermediary effect of capital buffers and helps reduce commercial banks' risk exposure.*

KEYWORDS: *Financial Innovation; Capital Buffer; Risk-taking*

1. Introduction

The 19th National Congress of the Communist Party of China report proposed to keep the bottom line of systemic financial risks. In December 2017, the Central Economic Work Conference determined that the next three years will be to fight against and defuse major risks, focusing on the prevention and control of financial risks. Guo Shuqing, Chairman of the China Banking and Insurance Regulatory Commission, appeared on the "Ministerial Channel" of the two sessions on the afternoon of March 9, 2018, and stated that the banking industry is the main battlefield for preventing financial risks. The government work reports of the Prime Minister in 2018 and 2019 have repeatedly mentioned the need to prevent and resolve major financial risks. In recent years, with the advancement of the interest rate market reform process and the introduction of the deposit insurance system, it has become increasingly difficult for commercial banks to profit from the loan-to-deposit interest rate differential, and traditional deposit products have become increasingly difficult to satisfy investors. Investment needs. These supply-side and demand-side changes objectively urge commercial banks to discover new profit growth points through financial innovation to meet the diverse needs of investors and their own needs for transformation and development.

However, the financial innovation of commercial banks is a "double-edged sword"[1]. While promoting the development of the banking industry, it also brings great uncertainty to the financial market. The financial crisis that swept the world in 2008 is inseparable from banking financial innovation.

Existing studies have shown that the capital buffer of commercial banks plays an important role in effectively curbing excessive risk-taking by commercial banks and preventing systemic risks, and is irreplaceable by other banking regulatory tools[2]. However, there are few literature studies on the relationship between financial innovation, capital buffers and risk-taking in commercial banks. Therefore, under the economic background of "mass entrepreneurship and innovation", "stabilizing growth, adjusting structure", "preventing and resolving major financial risks" and the reform of interest rate marketization, it is clear what impact financial innovation has on the capital buffer of commercial banks? What role does the buffer play in the financial innovation of commercial banks for their risk-taking? It will help commercial banks to correctly carry out financial innovation and give full play to the capital buffer's role in preventing and controlling bank risks. It will also help the supervisory authority to grasp the degree and level of bank innovation. The intensity of its own supervision, balance the relationship between innovation and supervision.

2. Literature Review and Hypothesis

The literature on the impact of financial innovation of commercial banks on their own business is mainly developed from the dimensions of financial innovation on the type of banking business, benefits and risks. Scholars are used to measuring the degree of financial innovation of commercial banks by the income generated by non-interest business[3][4]. Commercial banks have achieved diversified operations through the development of non-interest business, improved their income structure[5], reduced the proportion of risk-free assets in the entire loan, and increased the bank's expected profit[6]. Scholars choose financial institution profit[7] and bank total yield[8] as profit indicators. Empirical research has found that the more financial innovation, the better the performance of commercial banks. However, some scholars have found that financial innovation and performance are negatively correlated[9], irrelevant and non-linear[10]. Performance is always accompanied by risk. There are two main views on the relationship between innovation and risk: "innovation promotion theory" and "innovation destruction theory"[4].

Regarding the impact of capital buffers on commercial banks, scholars mainly discuss from both macro and micro aspects. On the macro level, the capital buffers of listed banks in China are significantly countercyclical[2]. After subdividing the attributes, it is found that the capital buffers of state-owned and joint-stock banks are countercyclical, while the capital buffers of city commercial banks are procyclical[11]. At the micro level, the capital buffer has a negative correlation with bank credit behavior and a positive correlation with securities investment behavior[12]. However, Chen Weiping[13] found that banks with higher capital buffers will issue more loans and hold There are more high-risk assets. The research on the impact of capital buffer on commercial banks' risk-taking has formed three conclusions: reduce,

increase[14] and "U" type[15].

Existing literature studies have shown that whether the impact of commercial bank financial innovation on their risk-taking is reduced or increased, and the conclusion is uncertain; as a preventive mechanism for commercial banks to hedge risks, what is the relationship between capital buffer and financial innovation? There is little research on the role of commercial banks' financial innovation in their risk-taking process.

The capital buffer of a commercial bank is the difference between the actual capital adequacy ratio of a commercial bank and the minimum capital adequacy ratio required by the regulatory requirements. The actual capital adequacy ratio of a commercial bank is the ratio of the amount of capital to the risk-weighted assets. Capital is composed of expected profits and own capital[2]. Financial innovation has the potential to increase revenue and increase profits[7][8], thereby increasing the amount of capital, affecting commercial banks' capital buffers and commercial banks' risk-taking; however, financial innovation is also a "double-edged sword"[1], and it is also possible Changing the risk appetite of commercial banks and increasing the proportion of risky assets[12] will affect the capital adequacy ratio of commercial banks. Therefore, this article proposes the following hypotheses:

H: Financial innovation has an impact on capital buffers, but there are uncertainties in the impact; capital buffers can play an intermediary role in the impact of financial innovation on commercial banks' risk-taking.

3. Research Design

(1) Variable Setting

1) Commercial Bank Risk

Drawing lessons from the articles of scholars such as Cao Tingqiu and Wang Ying[16], Li Wei'an, etc.[17], Wang Yonghai and Zhang Tao[4], this article uses the non-performing loan ratio to measure the bank's risk exposure.

2) Capital buffer

Drawing lessons from the article by Jiang Hai et al.[2], the difference between the bank's capital adequacy ratio and 8% is used to measure the degree of capital buffering of commercial banks.

3) Measurement of financial innovation

With reference to the indicators of Wang Yonghai and Zhang Tao[4], we choose "fee and commission income/total operating income" as an alternative indicator of financial innovation for research.

4) Selection of control variables

Combining with the "three characteristics" principle followed by commercial banks' operation and management, this article selects control variables from the

perspectives of bank scale, asset-liability ratio, return on net assets, cost-return ratio, and loan-to-deposit ratio. The definition and calculation of specific indicators are shown in Table 1 below:

Table 1 Definition table of related variables

Variable	Definition of variables
Risk	Commercial bank risk, equal to the non-performing loan rate of commercial banks
Buf	The capital buffer of commercial banks is equal to the capital adequacy ratio of commercial banks minus 8%
Innovation	The degree of financial innovation is equal to handling fees and commission income/total operating income
Size	The scale of a commercial bank is equal to the natural logarithm of the total assets of the commercial bank
Level	The debt-to-asset ratio of commercial banks is equal to total liabilities/total assets of commercial banks
Roe	Return on net assets of commercial banks, net profit/net assets of commercial banks
EQ	Commercial bank loan-to-deposit ratio, equal to commercial bank loan balance/deposit balance
Cost	The cost-benefit ratio of a commercial bank is equal to the total operating cost/total operating income of the commercial bank

(2) Research Model

In order to test the aforementioned hypothesis, this article refers to the mediation effect test procedure used by Yu Donghua and Sun Ting[18]. First, construct model(1) to test whether commercial banks' financial innovation affects their risk-taking. If the regression coefficient β_1 of the explanatory variable Innovation in model(1) is significant, it indicates that the financial innovation of commercial banks affects their risk-taking, and there is a stable relationship between the two, and the intermediary relationship can be further explored.

$$Risk = \beta_0 + \beta_1 Innovation + \beta_2 CV_1 + \varepsilon \qquad (1)$$

Secondly, construct model(2) to test whether the financial innovation of commercial banks affects their capital buffers. If γ_1 in the formula(2) is significant, it indicates that the financial innovations of commercial banks have an impact on their capital buffers.

$$Buf = \gamma_0 + \gamma_1 Innovation + \gamma_2 CV_2 + \eta \qquad (2)$$

Finally, construct model(3) to test whether the capital buffer plays an intermediary effect in the influence of commercial banks' financial innovation on their risk-taking.

$$Risk = \alpha_0 + \alpha_1 Innovation + \alpha_2 Buf + \alpha_3 CV_1 + \varepsilon \quad (3)$$

In the above models(1), (2) and (3), CV_1 is the risk-taking control variable of

commercial banks, and CV_2 is the capital buffer control variable. In the test results, if the coefficients γ_1 and α_1 in models(2) and (3) are significant, and α_2 in model(3) is also significant, it is a partial mediation effect; if the coefficient γ_1 in model(2) is significant, model(3) The medium coefficient α_2 is significant, and α_1 is not significant, it is a complete mediation effect. The specific relationship is shown in Figure 1:
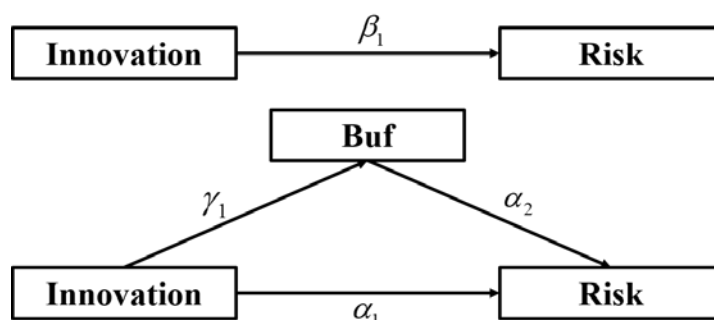

Figure 1 Test chart of mediation effect

(3) Samples and Data

For the comparability of accounting information, this article selects 2007-2018 Shenzhen and Shanghai A-share listed banks as the research object. The data mainly comes from the CSMAR database. The missing data is manually sorted by downloading relevant annual reports from Juchao Information Network. supplement. The software used in the regression process in this article is Stata 15.0.

4. Empirical Results and Analysis

(1) Descriptive statistical analysis of variables

Through the descriptive statistical analysis in Table 2, it can be seen that the degree of financial innovation, capital buffer, and risk-taking indicators of commercial banks are different in different banks and years.

Table 2 Descriptive statistical analysis of variables

Variable	Observations	Means	ST.D	Quantile		
				P25	P50	P75
Risk	221	0.0131	0.0057	0.0089	0.0127	0.0159
Innovation	217	0.1799	0.0847	0.1128	0.1765	0.2256
Buf	221	0.0483	0.0235	0.0350	0.0446	0.0587
Size	217	28.3987	1.4919	27.5089	28.5075	29.4454
Roe	217	0.1521	0.0395	0.1247	0.1506	0.1790
Cost	217	0.5802	0.1021	0.5086	0.5638	0.6290

| Level | 217 | 0.9346 | 0.0138 | 0.9259 | 0.9360 | 0.9420 |
| EQ | 217 | 0.5996 | 0.0864 | 0.5469 | 0.6009 | 0.6601 |

(2) Empirical results and analysis

In the regression process, this article uses the "xtscc,fe" command to estimate, the purpose is to reduce the possible impact of heteroscedasticity and cross-sectional correlation on the regression results[18], the empirical results are shown in Table 3:

Table 3 Regression results of mediating effect test

	Model(1) Risk	Model(2) Buf	Model(3) Risk
Innovation	0.0277*** (3.75)	-0.0476** (-2.10)	0.0236** (2.64)
Size	-0.0008 (-0.31)	-0.0078 (-1.01)	-0.0013 (-0.46)
Roe	0.0223 (0.69)	0.0228 (0.82)	0.0253 (0.76)
Cost	0.0103* (1.77)		0.0111 (1.58)
Level	-0.0356 (-0.89)	-1.5669*** (-8.82)	-0.1654* (-1.99)
Eq	-0.0062 (-1.56)	-0.0530** (-2.30)	-0.0105*** (-3.01)
Buf			-0.0806** (-2.71)
Cons	0.0675 (1.68)	1.7683*** (7.65)	0.2118*** (3.17)
Year	Yes	Yes	Yes
N	217	217	217
Within R-squared	0.5703	0.7372	0.5933
F	4891353.45***	1090924.07***	368459.34***
Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively.			

The regression results of model (1) in Table 3 show that the regression coefficient of financial innovation and risk-taking is 0.0277, which is significant at the 1% level, indicating that there is a significant positive correlation between financial innovation and risk-taking of commercial banks, and the intermediary relationship can be further discussed . The regression result of model (2) shows that the regression coefficient of financial innovation and capital buffer is -0.0476, which is significant at the 5% level, indicating that financial innovation and capital buffer are negatively correlated. The regression results of model (3) show that the regression coefficient of the intermediary variable capital buffer to risk exposure is -0.0806, which is significant at the 5% level, indicating that the capital buffer of commercial banks reduces the risk exposure of commercial banks; the regression coefficient of financial innovation to risk exposure is 0.0236 Statistically significant at the 5% level, indicating that financial innovation has increased the risk exposure of commercial banks. Combining model (2) the regression coefficient of financial innovation on capital buffer is -0.0476, which is significant at the 5% level, and the

principle of the intermediary effect test, this paper finds that the capital buffer plays an intermediary effect in the role of commercial bank financial innovation on commercial banks' risk taking , That is, financial innovation reduces the capital buffer of commercial banks, leading to an increase in commercial banks' risk-taking.

(3) Robustness test

The robustness test in this paper is mainly carried out by replacing explanatory variables. The logarithm of bank fees and commission income is used to measure the degree of financial innovation of commercial banks (Innovation2)[19], and the inspection methods and procedures are the same as above. The specific empirical results are shown in Table 4:

Table 4 Robustness regression test results of the mediation effect

	Model(1) Risk	Model(2) Buf	Model(3) Risk
Innovation2	0.0028**	-0.0219***	0.0009
	(2.32)	(-3.35)	(0.37)
Size	-0.0023	0.0332*	0.0006
	(-0.77)	(2.05)	(0.11)
Roe	0.0274	0.0715**	0.0363
	(0.75)	(2.34)	(0.91)
Cost	0.0145**		0.0162**
	(2.31)		(2.21)
Level	-0.0649	-1.8020***	-0.2237*
	(-1.45)	(-8.44)	(-1.77)
Eq	-0.0058	-0.0314	-0.0086**
	(-1.27)	(-1.64)	(-2.12)
Buf			-0.0839*
			(-1.94)
Cons	0.0773*	1.3103***	0.1910***
	(1.94)	(6.09)	(3.49)
Year	Yes	Yes	Yes
N	217	217	217
Within R-squared	0.5558	0.7803	0.5765
F	50134.72***	306020.09***	2002977.50***
Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively.			

In Table 4, model(1) the regression coefficient of financial innovation and risk-taking is 0.0028, which is significant at the 5% level; model(2) the regression coefficient of financial innovation index to capital buffer is -0.0219, which is significant at the 1% level; model(3) The regression coefficients of capital buffers on bank risk exposure are -0.0839, which is significant at the level of 10%. Combined with the aforementioned principle of intermediary effect test, it shows that capital buffers play an intermediary effect in the role of commercial banks' financial innovation on their risk exposure. The original conclusion is the same.

5. Further Analysis

It has been proved that capital buffers play a significant intermediary effect in the process of financial innovation of commercial banks on risk-taking. Due to the high complexity of financial innovation and the uncertainty of its impact on risks [5], the identification, evaluation and prevention of risks arising from its innovative products require professional judgment. The board of directors of commercial banks set up professional committees such as strategy and remuneration. The professional committees are composed of experts from various industries. Therefore, further research on whether the governance of professional committees can and through what channels can affect commercial banks' risk-taking is a positive effect in preventing and controlling risks in commercial banks. Meaningful topic. To this end, this article incorporates the governance capabilities of the professional committees of the board of directors into the research model, expands the intermediary effect model to a moderated intermediary effect model, and studies whether the governance of the professional committees of the board of directors can regulate the impact of financial innovation on commercial banks' risk-taking (direct Path) and the mediating role of capital buffers (the first half path and the second half path).

This article refers to Wen Zhonglin and Ye Baojuan[20] adjusting the mediation effect test procedures and methods, adopts the idea of gradual regression, selects the number of professional committees (Com) as the variable of professional committee governance ability, and completes the models(1),(2),(3) On the basis of the test, the number of professional committees(Com), the number of professional committees and the crossover item of financial innovation(Com-Inn), the number of professional committees and the crossover item of capital buffer(Com-Buf) Incorporating the model, constructing model(4) and model(5):

$$Risk = \beta_0 + \beta_1 Innovation + \beta_2 Com + \beta_3 Com\_Inn + \beta_4 CV1 + \varepsilon_{i,t} \quad (4)$$

$$Buf = \gamma_0 + \gamma_1 Innovation + \gamma_2 Com + \gamma_3 Com\_Inn + \gamma_4 CV2 + \eta_{i,t} \quad (5)$$

In the regression results of model(4) in Table 5, the number of professional committees and the cross-product regression coefficient of financial innovation is 0.0101, which is not significant, indicating that the direct path of financial innovation to commercial banks' risk-taking is not regulated by the governance of professional committees. In the later research, there is no need to introduce the cross-product term of financial innovation and the number of committees, so the model(6) is constructed.

$$Risk = \alpha_0 + \alpha_1 Innovation + \alpha_2 Com + \alpha_3 Com\_Buf + \alpha_4 Buf + \alpha_5 CV1 + \varepsilon_{i,t} \quad (6)$$

The regression results of model(5) in Table 5 show that the regression coefficient of financial innovation to capital buffer is 0.1302, which is not significant; the regression coefficient of financial innovation and committee governance cross-term is -0.0354, which is significant at the 1% level; model(6) capital The risk-taking coefficient of the buffer to commercial banks is -0.2827, which is significant at the 1%

level; the cross-term coefficient of the capital buffer and committee governance is 0.0378, which is significant at the 10% level. With reference to Wen Zhonglin and Ye Baojuan's intermediary effect test method and Figure 2, it can be found that the governance of professional committees has played a regulatory role in the first and second half of the intermediary path of capital buffering, that is: commercial banks with fewer professional committees , Commercial banks with a large number of professional committees reduced the negative correlation between financial innovation and capital buffers, and strengthened the negative correlation between capital buffers and commercial banks' risk-taking.

Table 5 Regression results of the mediation effect

	Model(1) Risk	Model(2) Buf	Model(3) Risk
Innovation	-0.0353 (-0.6794)	0.1302 (1.5768)	0.0143 (1.1109)
Com	-0.0029 (-1.4004)	0.0077** (2.2444)	-0.0023* (-1.8763)
Com_Inn	0.0101 (1.2689)	-0.0354*** (-2.8804)	
Size	-0.0012 (-0.3091)	-0.0078 (-0.9932)	-0.0014 (-0.3074)
Roe	0.0199 (0.4849)	0.0279 (0.7797)	0.0336 (0.7368)
Cost	0.0099 (1.3514)		0.0147 (1.3488)
Level	-0.0417 (-0.6287)	-1.5990*** (-11.5389)	-0.2144* (-1.7356)
Eq	-0.0129** (-2.5755)	-0.0443* (-1.8707)	-0.0170*** (-3.3676)
Buf			-0.2827** (-2.1342)
Com_Buf			0.0378* (1.8442)
Cons	0.1068 (1.6988)	1.7530*** (7.6457)	0.2720*** (2.9552)
Year	Yes	Yes	Yes
N	193	193	193
Within R-squared	0.5947	0.7599	0.6132
F	1.18e+07***	251791.73***	3874265.54***
Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively.			

6. Research Conclusions and Policy Recommendations

This article uses the 2007-2018 annual report data of Shanghai and Shenzhen A-share listed commercial banks to empirically study the relationship between financial innovation, capital buffers and commercial bank risk-taking. The research found that:(1) Financial innovation increases the risk-taking of commercial banks

and reduces the capital buffer of commercial banks;(2) The capital buffer of commercial banks has a negative correlation with the risk-taking of commercial banks, and the capital buffer is related to the risk-taking of commercial banks. There is a significant intermediary effect in the impact of financial innovation, that is: financial innovation reduces the capital buffer of commercial banks, thereby increasing the risk of commercial banks;(3) the governance of professional committees in the board of directors regulates the intermediary effect of capital buffers.

Under the current background of encouraging innovation and preventing and dissolving major financial risks, the author makes the following suggestions: (1) Commercial banks should grasp the appropriateness of financial innovation. Financial innovation will reduce the capital buffer of commercial banks, and the decline in capital buffer is not conducive to commercial banks' risk-taking. Excessive financial innovation of commercial banks is not good for commercial banks and the country to prevent and resolve financial risks; (2) Commercial banks that are too innovative should increase their capital adequacy ratios and increase capital buffers to cope with possible future commercial banks. (3) The state must strengthen the supervision of innovative businesses carried out by commercial banks. For "pseudo-innovation" businesses in the name of innovation and circumvent the realities of supervision, they must strengthen supervision; (4) Professionals in the board of directors of commercial banks The governance of committees helps to reduce the risk of commercial banks. Commercial banks should create conditions to introduce relevant professional committee talents to give full play to the professional governance role of professional committees.

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