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Bank Diversification and Performance:
The Role of Financial Stability

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ABSTRACT
The purpose of the study tries to examine whether commercial banks can adopt the strategy of bank diversification to improve the operating performance under the condition of financial stability. By using 19 commercial banks in Macau SAR, the study employing ROA to measure bank performance and income diversification and asset diversification to measure bank diversification. Furthermore, the study employs capital adequacy ratio, non-performing loan ratio, liquidity ratio and financial stability index to measure financial stability to measure financial stability as moderators in the estimation regression. The results of empirical study indicate that income diversification has a significant and positive effect on bank performance, while asset diversification has no significant and positive effect on bank performance. Furthermore, among the moderators of financial stability, liquidity ratio and financial stability index have facilitating effect on the relationship between income diversification and bank performance.

Keywords: *Income Diversification, Asset Diversification, Financial Stability*

1. INTRODUCTION

Subject to the substantial impact from the subprime mortgage financial crisis of 2008-2009 and European debts crisis of 2010-1011, commercial banks have involved in lubricant operations due to the policy of lower interest rates to stimulate economy. This has driven commercial banks to change the operation strategies, which commercial banks have aggressively engaged into non-interest banking activities such commonwealth services, fee income services, off-balance sheet services etc. Recently, many scholars have committed to investigate the relationship between bank diversification and performance. Most of studies have found the positive effect of bank diversification on performance. Gurbuz, Yanik, and Ayturk[1] find that bank diversification has significant and positive impact on adjusted-risk performance using a case of Turkish banks. Moudud-Ul-Huq et al. [2] also find that bank diversification has positive effect on performance in 5 ASEAN countries. However, some studies have evidence on negative relationship between bank diversification and performance. Mulwa and Kosgei [3] show that income diversification and asset diversification have negative impact on return on assets in Kenya. Winton [4] conclude that bank diversification will increase the possibility of bank failures if bank is lack of expertise and experience in diversification activities.

The prior studies have empirically examined the relationship between bank diversification and performance. However, few studies consider financial environment in the view of financial stability. To fill the research gap, the study tries to investigate the effect of bank diversification on performance. Furthermore, the study also examines the facilitation or inhibition effects of financial stability on the relationship between bank diversification and performance.

The study contains five sections. The introduction is in the first section. The second section describes the literature review and presents the hypotheses. Data and methodology reveal in the third section. Empirical results are shown in the fourth section. Final section presents conclusion.

2. REVIEW OF LITERATURE

Generally, diversification means involving in more areas and/or products. As to commercial banks, diversification is expected bringing more non-interest income and enriching the asset structure of banks, which are usually named as income diversity and asset diversification. Moreover, operating diversification is an

efficient measure to disperse risk and improve performance to commercial banks.

2.1 Bank Diversification and performance

Historically, commercial banks have aggressively induced customers to deposit saving and borrow funds. Furthermore, commercial banks try to provide full-range financial services for their customers. Bank diversification is a good strategy to meet the needs of customers and can earn more profits and reduce risks. Most empirical studies have evidence that income diversification has positive influence on bank performance [5-8]. The study of Demirgüç-Kunt and Huizinga [9] show that the increase of non-interest income can significantly improve bank performance in case of 1,334 commercial banks from 101 countries, although excessive proportion of non-interest income may cause more risk.

Conversely, using the data of 88 Chinese commercial banks, Berger, Hasan and Zhou [10] examines the effect of bank diversification on performance from four dimensions including loans, deposits, assets and geographical location, and finds that bank diversification reduces returns and increases costs.

In general, commercial banks adopt diversification strategy to promote banking activities to earn profits and reduce risk. Then, the study presents the following hypotheses:

H1: Bank diversification has positive impact on performance.

2.2 Financial stability as a moderator

Financial stability is related to the public's welfare [11]. Financial stability provides payments services or allocate credit to investment opportunities and boosts economic activities [12]. Adversely, financial instability caused by savings-investments imbalance, abnormal volatility of capital flows, sharp fluctuations of foreign exchange rates shocks to financial system interfere information disruptions, which leads to an inefficient allocation of savings to investments opportunities [13,14].

Under financial stability, an economy mechanism for pricing, allocating and managing financial risks is functioning well in contribution to the economic performance [15]. Then, commercial banks can reduce risks and perform effectively in the uncertain environments. The study uses indicators of capital adequacy ratio, non-performing loan ratio, liquidity ratio and financial stability index to measure financial stability referring to the study of Manu et al. [16] and Alsamara et al. [17]. Then, the study presents the following hypotheses:

H2: The capital adequacy ratio facilitates relationship between bank diversification and performance.

H3: The non-performing loan ratio inhibits relationship between bank diversification and performance.

H4: The liquidity ratio facilitates relationship between bank diversification and performance.

H5: The financial stability facilitates relationship between bank diversification and performance.

3. DATA AND METHODOLOGY

3.1 Data and Sample

The annual data of the study over the period from 2010 to 2019 are selected from Government Printing Bureau of Macau. The samples of the study are 19 commercial banks in Macau SAR, China and the study has totally the 190 observations.

3.2 Dependent Variables

Researchers have commonly used ROA to measure the operational performance of firms. Then, the study employs ROA as the dependent variable to measure bank performance. ROA is proxy of net profit scaled by total assets, which is:

$$ROA = \frac{\text{Net incomes}}{\text{Total assets}} \quad (1)$$

3.3 Independent Variables

The study employs two independent variables of income diversification (ID) and asset diversification (AD) to measure bank diversification. Referring to the studies of Alkhouri and Arouri [18], the measurement of income diversification is as follows:

$$ID = 1 - \left(\frac{Interest\ income}{Total\ income}\right)^2 - \left(\frac{Non-interest\ income}{Total\ income}\right)^2 \quad (2)$$

The value of income diversification is between 0 and 1. If the bank has value of income diversification tended 0, which implies the bank operates more concentrated; If the bank has value of income diversification tended 1, which implies the bank operates more diversified.

In addition, the study also employs assets diversification to measure bank diversification. Referring to the study of Alkhouri and Arouri [18], the measurement of asset diversification is as follows:

$$AD = 1 - \left(\frac{Loans}{Total\ assets}\right)^2 - \left(\frac{Non-loans\ assets}{Total\ assets}\right)^2 \quad (3)$$

The value of asset diversification is between 0 and 1. If the bank has value of asset diversification closed 0, which implies the bank has concentrated operations; If the

bank has value of asset diversification closed 1, which implies the bank has diversified operations.

3.4 Moderating Variables

The study adopts industry-level capital adequacy ratio (CAR), non-performing loan ratio (NPL), liquidity (LIQ) and financial stability index as proxies of financial stability by referring to Manu et al. [16].

$$CAR = \frac{Self\ \ Capital}{Risk-weighted\ \ Assets} \quad (4)$$

$$NPL = \frac{Non-performing\ \ Loans}{Total\ \ Loans} \quad (5)$$

$$LIQ = \frac{Liquidity\ \ Assets}{Total\ \ Assets} \quad (6)$$

Referring to Manu et al.[16] and Dhiman[14], the study uses three factors of industry-level capital adequacy ratio, non-performing loan ratio and liquidity to construct financial stability index, which is the equal weighted of sum of industry-level capital adequacy ratio, non-performing loan ratio and liquidity. The measurement is as follows:

$$FSI = \beta_1 CAR + \beta_2 NPL + \beta_3 LIQ \quad (7)$$

Whereas, $\beta_1 + \beta_2 + \beta_3 = 1$. The study uses equal weights in the above equation.

3.5 Control Variables

Referring to the previous studies, this study adds four control variables of bank size, leverage ratio, net income margin, and Z-score into the estimation regression to control for firm-level heterogeneity.

Bank size reflects that total resources held by a bank are used to as competitive advantages. Bank size is measured by the natural logarithm of the bank assets. Leverage ratio is that a bank takes advantages of external debts and is measured by ratio of total liabilities to total assets. Net income margin implies that a bank has ability of net interest-earnings and is measured by interest income minus interest expenses scaled interest-bearing assets. Z-score reveals that a bank has ability of anti-risks and is measured by ROA plus equity divided by total assets, scaled standard deviation of ROA.

3.6 Research Models

For investigating the hypotheses 1, the study constructs a multiple linear regression model to examine the effect of income diversification and asset diversification on bank performance, controlling for four control variables: bank size, financial leverage, net income margin and Z-score, which show as following:

$$ROA_{it} = \alpha_0 + \alpha_1 ID_{it} + \alpha_2 AD_{it} + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \alpha_5 NIM_{it} + \alpha_6 ZS_{it} + \varepsilon_{it} \quad (8)$$

For investigating the hypotheses 2, 3, 4, and 5, the study employs four moderators of industry-level capital adequacy ratio, non-performing loan ratio, liquidity ratio and financial stability index to examine their facilitation or inhibition effects on the relationship between bank diversification and performance, controlling for four control variables: bank size, financial leverage, net income margin and Z-score, which shows as following:

$$ROA_{it} = \beta_0 + \beta_1 ID_{it} + \beta_2 AD_{it} + \beta_3 FS_t + \beta_4 ID_{it} * FS_t + \beta_5 AD_{it} * FS_t + \beta_6 SIZE_{it} + \beta_7 LEV_{it} + \beta_8 NIM_{it} + \beta_9 ZS_{it} + \varepsilon_{it} \quad (9)$$

Where, FS denotes industry-level capital adequacy ratio, non-performing loan ratio, net income margin and financial stability index, respectively.

4.EMPIRICAL RESULTS

4.1 Description analysis

Table 1 indicates that characteristics of all variables. Refer to dependent variable, ROA is between 0.033 and 0.003 with lower-level value due to industrial feature of high financial leverage. Both of ID being between 0.500 and 0.006 with mean of 0.312 and AD being between 0.499 and 0.087 with mean of 0.426 indicate that banks have operation not more diversified. FSI shows that financial environment in Macau are more stable.

Table 1. Description Analysis

Var	Obs.	Max	Min	Mean	Std
ROA	190	0.033	-0.003	0.009	0.004
ID	190	0.500	0.060	0.312	0.120
AD	190	0.499	0.087	0.426	0.084
CAR	190	0.167	0.141	0.149	0.008
NPL	190	0.004	0.001	0.002	0.001
LIQ	190	0.453	0.308	0.367	0.044
FSI	190	0.200	0.158	0.172	0.013
SIZE	190	20.417	12.863	16.668	1.657
LEV	190	0.998	0.078	0.889	0.194
NIM	190	0.023	-0.009	0.012	0.004
ZS	190	838.218	0.844	62.112	162.497

4.2 Correlation Analysis

Table 2 shows the correlation relationship of any two variables among all independent and control variables. This correlation coefficients of any two variables are less than 0.7 except LIQ and FSI, which indicates any one variable can individually explain dependent variable independently.

Table 2. Correlation Analysis

Corr.	ID	AD	CAR	NPL	LIQ
ID	1.000				
AD	0.349	1.000			
CAR	-0.046	-0.049	1.000		
NPL	0.222	0.048	-0.166	1.000	
LIQ	0.305	0.074	-0.542	0.646	1.000
FSI	0.324	0.071	-0.394	0.684	0.985
SIZE	-0.218	0.313	0.135	-0.152	-0.243
LEV	-0.264	-0.109	0.052	-0.053	-0.111
NIM	0.097	0.031	0.010	-0.006	0.043
ZS	0.152	0.108	0.001	0.016	0.056

Table2. Correlation Analysis (continued)

Corr.	FSI	SIZE	LEV	NIM	ZS
ID					
AD					
CAR					
NPL					
LIQ					
FSI	1.000				
SIZE	-0.239	1.000			
LEV	-0.111	0.178	1.000		
NIM	0.048	-0.357	-0.310	1.000	
ZS	0.061	0.083	-0.896	0.167	1.000

4.3 Hausman Test

The results of Hausman test are shown in Table 3. Empirical model 1 should adopt fixed effect model; however, the rest of empirical models should adopt random effect models because their probabilities of Hausman test are less than 0.10.

Table 3. Results of Hausman Test

Model	χ2 stat	degree of freedom	Prob.
Model 1	10.911	6	0.091
Model 2	9.047	9	0.432
Model 3	10.337	9	0.323
Model 4	0.000	9	1.000
Model 5	9.220	9	0.417

4.4 Empirical Results

The empirical results of the study are shown in Table 4. According to the empirical results of Model 1, income diversification has a significant and positive effect on the bank performance, while asset diversification has no significant and positive effect on bank performance. This partially supports hypothesis 1.

As for the Model 2 to Model 5, the study adds a moderator of financial stability for explaining the moderating effect. The empirical results of the study find that CAR and NPL have no moderating effect on the relationship between bank diversification and performance. This does not support hypotheses 2 and 3. The empirical results of the study show that LIQ and FSI significantly facilitate the relationship between income diversification and bank performance, while LIQ and FSI have no moderating effect on the relationship between asset diversification and bank performance. This partially supports hypotheses 4 and 5.

Table 4. Results of Estimation Regression

Var	Model 1	Model 2	Model 3	Model 4	Model 5
C	-0.043 *** (0.010)	-0.057 ** (0.023)	-0.022 *** (0.007)	0.006 (0.013)	0.017 (0.019)
ID	0.009 ** (0.004)	0.003 (0.049)	0.004 (0.006)	-0.031 (0.022)	-0.048 (0.033)
AD	0.004	0.067	0.007	-0.012	-0.019
	(0.004)	(0.058)	(0.009)	(0.026)	(0.040)
CAR		0.238 (0.158)			
NPL			-0.512 (1.811)		
LIQ				-0.076 ** (0.031)	
FSI					-0.232 ** (0.102)
ID _CAR		0.011 (0.335)			
AD _CAR		-0.425 (0.389)			
ID _NPL			1.467 (2.725)		
AD _NPL			-1.944 (4.105)		
ID _LIQ				0.107 * (0.060)	
AD _LIQ				0.047 (0.072)	
ID _FSI					0.330 * (0.192)
AD _FSI					0.140 (0.237)
SIZE	0.002 *** (0.001)	0.001 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.001 (0.000)
LEV	0.015 ** (0.007)	0.019 *** (0.005)	0.021 *** (0.005)	0.022 *** (0.005)	0.022 *** (0.005)
NIM	0.502 *** (0.091)	0.452 *** (0.083)	0.472 *** (0.080)	0.453 *** (0.078)	0.467 *** (0.078)
ZS	0.000 ** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)
R^2	0.492	0.228	0.242	0.266	0.263
Adj-R^2	0.419	0.189	0.204	0.230	0.226
F-stat	6.083 ***	5.913 ***	6.403 ***	7.275 ***	7.147 ***

Note: * denotes significance at level of 10%; ** denotes significance at level of 5%; *** denotes significance at level of 1%. Values in the parenthesis are standard errors.

4.5 Robustness Test

The study tries to use robustness test to examine whether empirical models have robustness by employing EBIT/Sales instead of ROA. According to the results of robustness test, the results is same to the previous results.

Table 5. Robustness Test of Estimation Regression

Var	Model 1	Model 2	Model 3	Model 4	Model 5
C	-1.524 *** (0.304)	-2.143 *** (0.728)	-1.338 *** (0.362)	0.709 * (0.422)	1.279 ** (0.578)
ID	-0.280 ** (0.119)	-1.142 (1.492)	-0.394 * (0.208)	-1.753 *** (0.663)	-2.502 ** (0.972)
AD	-0.026 (0.131)	2.161 (1.742)	0.040 (0.289)	-0.925 (0.766)	-1.363 (1.180)
CAR		5.014 (4.721)			
NPL			-26.563 (54.595)		
LIQ				-3.160 *** (0.909)	
FSI					-10.207 *** (2.977)
ID _CAR		5.659 (10.030)			
AD _CAR		-14.602 (11.619)			
ID _NPL			68.316 (81.736)		
AD			-32.217		

_NPL			(132.681)		
ID_LIQ				3.735** (1.779)	
AD_LIQ				2.528 (2.100)	
ID_FSI					12.401** (5594)
AD_FSI					7.855 (6.879)
SIZE	0.112*** (0.017)	0.105*** (0.019)	0.101*** (0.018)	0.034*** (0.012)	0.034*** (0.012)
LEV	0.441** (0.212)	0.434** (0.213)	0.486** (0.215)	0753*** (0.176)	0.774*** (0.176)
NIM	0.125 (2.671)	-0.602 (2.817)	-0.708 (2.765)	-4.565* (2.432)	-4.059* (2.409)
ZS	0.000** (0.000)	0.000** (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)
R^2	0.739	0.742	0.745	0.548	0.548
Adj-R^2	0.701	0.699	0.702	0.526	0.526
F-stat	19.532***	17.322***	17.539***	24.306***	24.321***

Note: * denotes significance at level of 10%； ** denotes significance at level of 5%; *** denotes significance at level of 1%. Values in the parenthesis are standard errors.

5. CONCLUSION

The purpose of this study is to investigate the effect of bank diversification and performance by using samples of 19 commercial banks in Macau SAR. The study also examines the moderating effect of financial stability on relationship between bank diversification and performance.

According to the empirical results, the study concludes that income diversification has a significant and positive impact on bank performance, and liquidity ratio and financial stability index have facilitating effect on the relationship between income diversification and bank performance.

Based on the results of the study, the study would suggest that commercial banks in Macau SAR could increase non-interest income to improve bank performance, and banks can improve banking activities by taking advantage of financial stability.

AUTHORS' CONTRIBUTIONS

Shun-Ho Chu contributed significantly to the main conception, empirical analysis and manuscript preparation; Shun-Ping Li performed the analysis with discussion and wrote the Part 4 and Part 5 of this paper; Xue-Ying Xia, Xiao-Yu Liu, Jia-Xia Li and Su-Jun Zhang worked together to write the rest part of this paper.

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