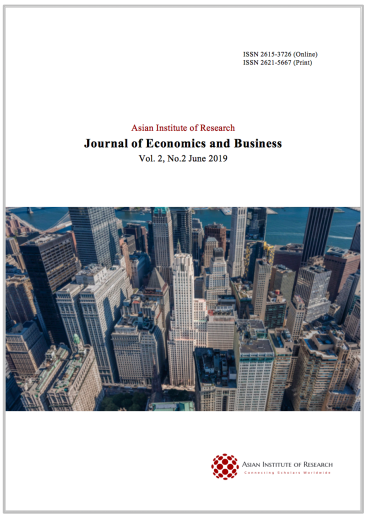

Journal of Economics and Business

Linh, Do Hoai, and Trang, Vu Kieu. (2019), Impact of Capital on Profitability of Banks: Evidence from Vietnamese Commercial Banks. In: *Journal of Economics and* Business, Vol.2, No.2, 379-395.

ISSN 2615-3726

DOI: 10.31014/aior.1992.02.02.94

The online version of this article can be found at:
https://www.asianinstituteofresearch.org/

Published by:
The Asian Institute of Research

The Asian Institute of Research *Journal of Economics and Business* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of Economics and Business, which includes, but not limited to, Business Economics (Micro and Macro), Finance, Management, Marketing, Business Law, Entrepreneurship, Behavioral and Health Economics, Government Taxation and Regulations, Financial Markets, International Economics, Investment, and Economic Development. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Journal of Economics and Business* aims to facilitate scholarly work on recent theoretical and practical aspects of Economics and Business.

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

The Asian Institute of Research
Journal of Economics and Business
Vol.2, No.2, 2019: 379-395
ISSN 2615-3726

DOI: 10.31014/aior.1992.02.02.94

Impact of Capital on Profitability of Banks: Evidence from Vietnamese Commercial Banks

Do Hoai Linh[1], Vu Kieu Trang[2]

[1] School of Banking and Finance, National Economics University, Vietnam, 207 Giai Phong Road, Hanoi, Vietnam. Email: linhdh@neu.edu.vn
[2] School of Advanced Education Programs, National Economics University, Vietnam, 207 Giai Phong Road, Hanoi, Vietnam. Email: vukieutrang1502@gmail.com

Abstract
This study aims to investigate the impact of capital on bank profitability with evidence from Vietnamese commercial banks. With a sample of 30 Vietnamese commercial banks, the findings show the positive relationship between capital and bank profitability during the period of 2012-2018. Accordingly, the influence of capital is more pronounce in the case of small-sized banks, whereas it exerts insignificant influence on the profitability of large-sized banks. Moreover, a high degree of capital increased the profitability of private-owned banks, the impact of capital is positive and significant for the net interest margin of state-owned banks only.

Keywords: Capital, Profitability, Commercial banks, Vietnam

1. Introduction

The effect that capital exerts on the profitability of commercial banks has turned into a cause of concern recently, especially when previous literatures on this relationship appear to be mixed. Capital has functions as a tool to help banks evade future risk and as a security instrument that absorbs any contamination effect. As a result, practitioners and regulators in Vietnam should pay attention to bank capital as it is explored that holding great amount of capital forces might exert beneficial impact on bank profitability (i.e., Tan, 2016; Iannotta et al., 2007; Demirgüç-Kunt and Huizinga, 2000). For example, Lee and Hsieh (2013), investigating the linkage between capital and profitability of bank by utilizing database for banks of 42 countries in Asia from 1994 to 2008, provide empirical evidence that a rise in capital is positively correlated with profitability of bank. In the same vein, a recent study of Tan (2016) on Chinese banking industry from 2003 to 2011 indicates that highly capitalized banks experience greater profitability. Nevertheless, one may concern that possessing greater capital ratios might impose constraints on operating activities of bank, deteriorate economic development, give rise to risk level of bank, and diminish efficiency as well as profitability. Altunbas et al. (2007), analyzing the association among capital, risk as well as efficiency in the case of banks in Europe for the period of 1992 - 2000, explore that banks which are inefficient tend to possess high level of capital. Indeed, it is shown that capital is negatively correlated with profitability

(Goddard et al., 2010). Furthermore, Vu and Nahm (2013), investigate factors that affect profit efficiency of Vietnamese banks between 2000 and 2006 and find banks with too high level of capitalization experience the profit inefficiency. In the analysis, Vietnam is focused as the empirical setting for several reason. Initially, since the early 1990s, Vietnam has experienced substantial transformation due to Doi Moi policy that the government launched in 1986. Through a chain of restructuring programs according to recapitalization and deregulation, banking sector of Vietnam has been reformed to be an open market. The government has gradually loosened regulatory constraints, which is exerted on the field consisting of ceilings interest rate on deposit and loan, branching and foreign-ownership restrictions, investment portfolio limitation. Because of these characteristics, Vietnam provides a fascinating context to investigate the factor affecting the banks' efficiency with a view to enhance profitability. Therefore, the impact of capital on profitability of bank with evidence from Vietnamese commercial banks was chosen to study.

2. Literature Review

Bank profitability

Achieving high profitability is one of the key objectives of a business as profit is considered as a financial indicator that determine the effectiveness of the entire operating process, which consists of investing, manufacturing, selling activities, and also of the technical and economic management decisions. Nevertheless, to attain a compressive evaluation of business operating outcome, it is necessary to not only consider to total amount of profit but also the linkage between profit and capitals, assets and resources that utilized to generate the profit. Hence, profitability ratio of firms is of great interest to managers, investors as well as other stakeholders. Profitability is one of the measurements of firms' performance. It is utilized to establish the association between profit and the size of the business. Profitability, thus, is probably understood as the capability of a business to effectively utilize resources and capitals to generate a return on an investment. There are a number of accounting ratios are utilized in prior studies to evaluate profitability of a bank. These ratios reflect a bank's capability of generating profit relative to associated expenses. A higher value of these profitability ratios in comparison with those of either competitors or previous value of the same bank normally presents a better operating outcome. Most scholars have used return on assets (ROE), return on equity (ROE) and net interest margin (NIM) as proxies for bank profitability (i.e., Dietrich and Wanzenried, 2011; Lee and Hsieh, 2013). ROA, calculated as net income of a bank to its total assets, shows whether a bank can effectively utilize its assets to produce profit or not. Greater ROA indicates that management of a bank is able to generate profit from assets in an effective way. Return on equity (ROE), which is the ratio that most concern by equity holder as it is the return of shareholders to their equity. The ratio measures a bank's capability of producing profit by utilizing equity capital. Net interest margin (NIM) is another ratio that is used to capture the financial performance of a bank. NIM concentrates on earning profit based on interest activities and is calculated by (interest income minus interest expense) to earning assets. More specifically, NIM is the difference between the amount that a bank is received from clients, and the amount that is depositors is offered. This measurement of profitability is primarily associated with traditional activities of lending and borrowing and is in line with the conventional characterization of a bank as it serves as an intermediary which connects lenders and borrowers. Besides these popular ratios used in a number of researches on bank profitability, there are also other ratios such as fraction of other operating income to three years average assets which is used by Bitar et al. (2018) to evaluate bank profitability. The researches started earlier usually employ simple ordinary least squares to investigate bank financial performance (i.e., Mayne, 1972). Nevertheless, more recent literatures (i.e. Brewer and Lee, 1986; Altunbas et al., 2007; Iannotta et al., 2007; Berger and Bouwman, 2017;) have switched to panel technique to provide analysis bank profitability because panel data allows researchers with the larger number of observations as well as it is able to capture the relevant association among variables over time. Moreover, recent scholars (i.e., Dietrich and Wanzenried, 2011; Lee and Hsieh, 2013) even adopt advanced technique, for example,

generalized method of moment or two-stage least squares to control for endogeneity problems, unobserved heterogeneity as well as dependent variables' persistence. A large literature has attempt to investigate some of key factors that affect profitability of individual bank. The corresponding literatures have concentrated their analysis on either evidence on cross-nation (i.e., Lee and Hsieh, 2013; Iannotta et al., 2007) or on the single nations' banking system (i.e., Berger, 1995). The empirical findings of the literatures mentioned above are mixed due to the difference in their datasets, period being examined, environment as well as country. Nonetheless, some mutual factors are found to be utilized to classify further the determinants of bank profitability.

Profitability belonging to individual bank is often affected by both internal and external factors. The internal factors might be the micro or bank-specific determinants of profitability. The external factors reflect macroeconomic or industry-specific factors which are anticipated to impose influence on the operation and outcome of financial institutions. According to prior studies, variables, for example, growth of deposit, size of bank, costs of funding and type of ownership are utilized as internal factors that influence bank profitability (i.e., Dietrich and Wanzenried, 2011; Lee and Hsieh, 2013). Dietrich and Wanzenried (2011) assess the factors that affects profitability of 372 Switzer commercial banks from 1999 to 2009 and find a significant influence of yearly growth of deposit and funding costs on bank profitability. Additionally, bank size is taken into consideration as another factor affecting profitability. Pasiouras and Kosmidou (2007), who investigate European banks, explore size positively influence bank's profitability. The reason is large-sized banks tent to obtain higher level of product and loan classification in comparison with small banks, which enable them to attain benefit from economies of scales. However, Micco et al. (2007) state that relative size of bank has no influence on the return on assets as the estimated coefficient is not statistically significant. There's empirical evidence that whether a bank is owned privately or by the government does have influence on its financial outcome (Micco et al., 2007). In developing countries, banks possessed by the government are likely to experience lower profit, lower margins, and higher overhead costs in comparison with banks owned privately. Iannotta et al. (2007) also provide the similar finding that private-owned banks experience greater profitability than banks owned by the government Regarding to macroeconomics determinants, the variables normally used are the inflation rate, growth rate of GDP and real interest rate (i.e. Dietrich and Wanzenried, 2011; Lee and Hsieh, 2013). Tan and Floros (2012) introduce the relationship between profitability of bank and inflation in banking industry of China. Their findings suggest that inflation is significantly associated with bank profitability. Additionally, according to Albertazzi and Gambacorta (2009), the GDP growth rate is explored to exert a positive impact on the return on equity (ROE) of banks. Lee and Hsieh (2013), studying on Asian banking over the period from 1994 to 2008, also find that real interest rate significantly affects bank profitability.

Bank capital

Bank capital is considered by regulatory consensus as a tool that guarantees the ability of a bank to protect itself against risk (Demirguc-Kunt et al., 2013). Banks holding more capital are capable of absorbing losses with their own business by using their own resources, without experience insolvency or need for a bailout with public funds (Demirguc-Kunt et al., 2013). Also, it is stated that the bank's probability of financial distress can be diminished by possessing greater capital (Diamond and Rajan, 2000). There are numerous definitions of bank capital. The ratio that commonly used as proxy for bank capital in previous literatures to assessing the effect of bank capital upon operating outcome is equity to assets ratio (i.e., Berger, 1995; Lee and Hsieh, 2013; Dietrich and Wanzenried, 2011; Berger and Bouwman, 2013). Nevertheless, there are other capital ratio that recently utilized to provide a more in-depth investigation of the influence of dissimilar kind of capital on performance of bank. Bitar et al. (2018), examining whether high capital ratios effectively help diminish risk and enhance the efficiency as well as profitability of banking institutions, utilize nine definition of capital so that they can determine which are the most efficient kind of capital ratios in elevate banking industry. The authors consider the ratio calculated based on the

Basel guideline by utilizing risk-weighted assets and then calculate the similar ratios but replace risk-weighted assets by total assets as well as tangible equity ratio. The ratios that are used in the study of Bitar et al. (2018) are: Tier 1 over risk-weighted assets; Tier 1 plus Tier 2 over by risk-weighted assets; common equity divided by risk-weighted assets; other capital divided by risk-weighted assets; Tier 1 over total assets, Tier 1 plus Tier 2 divided by total assets; common equity divided total assets; other capital to total assets; Tangibility equity divided by total assets. Additionally, Demirguc-Kunt et al. (2013) investigate if high capitalization enables banks to experience greater stock returns in financial crisis period. The researchers use other alternative capital ratios including: the risk-adjusted regulatory capital ratio; the Tier 1 regulatory ratio; the leverage ratio; the Tier 1 ratio and Tier 2 leverage ratio; the tangible common equity ratio. Economic literatures provide extensive discussion on how capital affects performance of bank (i.e., Berger and Bouwman, 2013; Mehran and Thakor, 2011; Tan and Floros, 2013). Firstly, it is found that there is a significant impact of capital on the probability of banks' survival. For example, Berger and Bouwman (2013) examine the correlation between capital and financial outcome of banks in US and indicate that small banks possessing high degree of capital experience high propensity of survival. Secondly, banking studies suggest that the effect that capital has on market share is positive (Mehran and Thakor, 2011) because highly capitalized banks have more advantages in competing for deposits and loans more compared to others (i.e., Calomiris and Mason, 2003; Kim, Kristiansen, and Vale, 2005). Thirdly, in crisis period, capital serves as an important tool to elevate the operating outcome of medium and large banks over the bank crisis period. It is stated that before the crisis, capital has no significant effect on banks' stock returns, however, during crisis period, a high degree of capital is related to better stock market performance (Demirguc-Kunt et al., 2013). Further, Mehran and Thakor (2011), developing a dynamic model of bank capital structure to analyze the association between capital and bank value, explore that bank's equity capital is positively related to bank value. Moreover, bank risk is significantly influenced by level of capital (i.e., Lee and Hsieh, 2013; Tan and Floros, 2013; Brewer and Lee, 1986; Jahankhani and Lynge, 1979). As suggested by Lee and Hsieh (2013), capital appears to negatively and significantly associated with risk, whereas its relationship with profitability is positive. Similarly, Tan and Floros (2013) who assess how bank efficiency, risk, and capital relate to each other for commercial banks in China by utilizing panel data framework, indicate that the level of capitalization has adverse impact on bank risk. On the contrary, it is argued that there is a positive relationship among bank capital and risk (i.e., Pettway, 1976; Shrieves and Dahl, 1992; Rime, 2001; Iannotta et al., 2007). Pettway (1976) adopting regression analysis to assess capital adequacy of the United State banks and bank holding firms during 1971 to 1974, shows that risk is significantly and positively affected by equity to total assets ratio of banks. Shrieves and Dahl (1992) also apply U.S database and come up with the conclusion of similar positive finding. The positive impact that capital exerts on bank risk is also supported by the studies of Rime (2001) and Iannotta et al. (2007), which employ database on European banks. Ultimately, bank efficiency is mentioned to be positively affected by capital (i.e., Fiordelisi et al., 2011; Sufian, 2010; Staub et al., 2010; Tan and Floros, 2013; Chortareasa, 2012). In particular, Fiordelisi et al. (2011) use the GMM estimators to conduct investigation on European banking and come to the conclusion that high level of capital has positive correlation with bank efficiency. In the same vein, the beneficial effect of capital on efficiency of bank is stated in the study of Sufian (2010) who do research on Chinese banking sector by adopting data development analysis (DEA), panel data and Tobit regression. Chortareasa et al. (2012) also give support to the notion of the positive relation among bank capital and efficiency by assessing the sample of banks belonging to 22 European countries.

Relationship between capital and profitability

The linkage between capital and bank profitability has been widely discuss in the literature (i.e., Altunbas et al., 2007; Goddard et al., 2010; Demirgüç-Kunt and Huizinga, 1999; Iannotta et al., 2007). According to previous empirical findings, the way that of bank capital influence profitability appears to be mixed. On the one hand, capital is indicated expert positive effect on profitability (i.e., Berger, 1995; Demirgüç-Kunt and Huizinga, 1999;

Iannotta et al., 2007). Berger (1995) closely investigate the capital-earning relationship in banking by employing the database of commercial banks in U.S during the period 1983-1989. The author concludes that capital and earnings have a strong association, and that each variable positively Granger-caused the other. There is likelihood that a rise in capital leads to a growth in income and vice versa. Demirgüç-Kunt and Huizinga (1999), examining factors that affect interest margin and profitability of commercial bank for 80 countries in the year 1988-1995, document a that capital significantly and positively influence net interest margin and profit before tax to total assets. In the same vein, Iannotta et al. (2007) finds that capital impose a significant and beneficial effect on profit of banks. More recently, Lee and Hsieh (2013), analyze the influence that capital has on financial performance of banks in Asia, provide evidence that capital affects net interest margin and net interest revenue over average assets of banks positively. The view of positive influence capital exert on profitability is also supported by the research conducted by Chortareasa et al. (2012) who investigate European banking and figure out that net interest margin is positively affected by the level of capital.

By contrast, the above-mentioned views have been challenged by other perspectives, which indicate banks that are inefficient tend to embrace greater capital (Altunbas et al., 2007). Indeed, Pettway (1976) adopting regression analysis on the database of United State Commercial banks. The author finds that capital requirements diminish the efficiency in operation of banking system. The reduction in operational efficiency will subsequently negatively affect profitability of banks. Additionally, Goddard et al. (2010) doing research on eight member countries in European Union in the period of 1992-2007, explore that capital ratio negatively affects profitability, which indicates the standardized risk-return payoff that more highly capitalized banks have low-risk level, and thereby are likely to experience less return. Furthermore, it found that a bank's profit efficiency of is hindered by a too high level of capitalization by Vu and Nahm (2013) who investigate the factors influencing profit efficiency of Vietnamese banks in the period of 2000-2006.

3. Methodology

3.1. Data collection

The database of this research includes 30 Vietnamese commercial banks in the period of 2012 to 2017. Secondary data is utilized for this study. The banks' financial data are acquired from the annual financial report belonging to 30 commercial banks collected by Viet stock. Also, Vietnam's macro factors are retrieved from World Bank. The financial and non-financial data in term of bank level include types of bank ownership (state-owned, private-owned), bank internal factors (return on assets, return on equity, net interest margin, annual deposit growth, banks' size, funding cost). Macroeconomics factors consist of annual GDP growth rate, inflation rate, domestic credit to private sector.

The reason the period of 2012 to 2017 is chosen to investigate the impact of capital on bank profitability is that in the year 2012, based on decision No. 254 / QD-TTg dated March 1, 2012, the Prime Minister accepted the project "restructure the system of credit institutions in the period 2011-2015 ”(hereinafter referred to as Project 254). This project has set goals for the 2011-2015 period is to “focus on constructing strong financial status and reinforce the operational capacity of credit institutions, enhance the degree of safety and efficiency of credit institutions’ performance, enhance order, discipline and market principles in banking operations.” To accomplish this goal, the project provided orientation and solution to reorganize the system of credit institutions for different group of credit institution. The commercial banks with the role and position of dominating the system of credit institutions must implement specific solutions including: (1) continue to promote the equitization of state-owned commercial banks; (2) increase scale and financial capacity; (3) enhance asset quality, control credit quality and reduce level of bad debt; (4) innovate banking control system; (5) modernize baking technology system; (6) continue to expand branch

network and transaction points; (7) check and strengthen key business activities; (8) diversify approaches of raising capital, manage credit growth to be suitable with source of capital; (9) rapidly develop management team, executive and high-quality staffs. As the project significantly affected the baking industry of Vietnam, the period from 2012 to 2017 provides us an interesting setting to assess the association between bank capital and profitability in Vietnam.

Estimation methods

To investigate the effect of capital on profitability of bank, panel data regression model is employed in which bank profitability is regressed on capital. In addition, other control variables of bank internal factors are also incorporated (*Deposit growth*, *Size*, *Funding cost*, *Ownership*) and macroeconomics factors (*GDP growth*, *Inflation*, *Lend*) that have some impact on profitability of bank and are commonly used in literatures (i.e., Lee and Hsieh, 2013; Dietrich and Wanzenried, 2011). Bank fixed effect is also included into the models. The regression models presented as follow:

$$ROA_{it} = \beta_0 + \beta_1 Capital_{it} + \beta_2 Deposit\ growth_{it} + \beta_3 Size_{it} + \beta_4 Funding\ cost_{it} + \beta_5 Ownership_{it} + \beta_6 GDP\ growth_{it} + \beta_7 Inflation_{it} + \beta_8 Lend_{it} + \varepsilon_{it} + \square_{it} \quad (1)$$

$$NIM_{it} = \beta_0 + \beta_1 Capital_{it} + \beta_2 Deposit\ growth_{it} + \beta_3 Size_{it} + \beta_4 Funding\ cost_{it} + \beta_5 Ownership_{it} + \beta_6 GDP\ growth_{it} + \beta_7 Inflation_{it} + \beta_8 Lend_{it} + \varepsilon_{it} + \mu_{it} \quad (2)$$

Where bank profitability of bank i at time t is proxied by return on assets (*ROA*) and net interest margin (*NIM*). $Capital_{it}$ is the level of bank capital, measured by the equity-to-asset ratio. $Deposit\ growth_{it}$ is annual growth rate of deposit. $Size_{it}$ is natural logarithm of bank's total asset. $Funding\ cost_{it}$ is interest expense over average total deposit. $Ownership_{it}$ is dummy variable takes value of 1 if the State own more than 50% of shares. $GDP\ growth_{it}$ is annual growth rate of GDP. $Inflation_{it}$ is annual inflation rate. $Lend_{it}$ is domestic credit to private sector. ε_{it} is bank fixed effect. μ_{it} is the residual term.

3.2 Descriptive statistic

3.2.1 Summary statistic

Tab 1. Summary statistic

	Observations	Mean	Standard deviation	Min	Max
ROA	178	0.5323	0.4503	-1.28	2.3926
NIM	178	2.6487	1.1772	-1.98	7.3
Capital	178	0.0911	0.0412	0.0133	0.2384
Deposit growth	177	26.2946	28.9513	-11.9426	210.7
Size	178	32.3114	1.1638	30.3178	34.723
Funding cost	178	0.0726	0.0367	0.0075	0.232
Ownership	180	0.2111	0.4092	0	1
GDP growth	180	0.0606	0.0059	0.0525	0.0681
Inflation	180	0.0467	0.0262	0.0088	0.0909
Lend	180	1.0973	0.1371	0.9483	1.3072

Table 1 demonstrates the summary statistic for banks' profitability, banks' internal factors, and macroeconomic factors. The mean, maximum value, minimum value, and standard deviation are documented for each variable.
In term of dependent variable, the average ROA of the sample is 0.5323, and the lowest ROA is -1.28 belonging to Vietbank in 2014 in comparison with the highest ROA of 2.3926 in 2017 achieved by Techcombank. Further, net interest margin has an average of 2.6487. The standard deviations for ROA and NIM are 0.4503 and 1.1772. Generally, the average ROA and NIM possessed by the banks in the database can be considered to be fairly good, since their mean are above 0.

Regarding to bank internal factors, the mean of capital is 0.0911 (9.11%), meaning that the portion of equity in bank' total asset is relatively low. The standard deviation of bank capital is quite low, which is only 0.0412. This indicates that there is a small difference between capital ratio in each Vietnamese commercial bank. Besides, deposit growth has the average value of 26.2946, which indicates that on average, the amount of deposit in banks increase over years. The lowest and highest value of deposit growth are -11.9426 belonging to Asia Commercial Joint Stock Bank in 2012 and 210.7 achieved by Bac A Bank in 2012, respectively. Additionally, size of banks has mean of 32.3114 and ranges from 30.3178 to 34.723. Finally, the funding cost of banks has minimum and maximum value of 0.0075 and 0.232. The standard deviation of deposit growth, size, and funding cost are 28.9513; 1.1638, 0.0367, respectively.

With the respect to macroeconomic factors, the value of GDP growth ranges from 0.0525 to 0.0681, and its mean is 0.0606, suggesting that on average Vietnam's GDP has increased over the period being examined. The sample has an average inflation rate fluctuating from 0.0088 to 0.0909 and average value of 0.0467. The mean of domestic credit to private sectors is 1.0973, and its maximum and minimum value are 1.3072 and 0.9483. This shows that private sector is received a high amount of credit for development. The standard deviations are 0.0059, 0.0262, and 0.1371 for GDP growth, inflation, and lend, respectively.

3.2.2 Correlation matrix

Tab 2. Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	*ROA*	1									
2	*NIM*	0.6399	1								
3	*Capital*	0.166	0.3826	1							
4	*Growth deposit*	-0.1188	-0.2274	0.0519	1						
5	*Size*	0.1342	-0.1177	-0.7464	-0.1699	1					
6	*Funding cost*	-0.0019	0.0183	0.3361	0.3475	-0.3463	1				
7	*Ownership*	0.1601	0.0776	-0.2508	-0.0444	0.4841	-0.2138	1			
8	*GDP growth*	-0.1474	-0.2088	-0.3079	-0.3415	0.1938	-0.5639	0.0155	1		
9	*Inflation*	0.2183	0.2404	0.2784	0.337	-0.1632	0.6371	-0.0513	-0.7044	1	
10	*Lend*	-0.0834	-0.1727	-0.3111	-0.3056	0.2026	-0.4677	0.0921	0.6402	-0.6715	1

The correlation matrix is utilized to present the relation among variables as well as investigated whether there is occurrence of multicollinearity issue in regression models. If the multicollinearity problem occurs in the model, it will cause a number of severe problems such as: the precision of the estimated coefficients is reduced, which weakens the statistical power of regression model or the conclusion of confident interval is unreliable and normally smaller than the precise confident interval.

Table 4.2. demonstrates the results of correlation matrix. It is found that the association between capital and return on assets (*ROA*) as well as net interest margin (*NIM*) of bank is positive. Among these relations, capital has the strongest effect on net interest margin with the correlation coefficient of 0.3826. The correlation matrix also shows that the correlation coefficient of two variables *Inflation* and *GDP growth* is highest, with the value of -0.7044 - the average correlation level. Other independent variables have lower level of correlation compared to this value. There are even relatively low correlation levels, such as the correlation coefficient between *Ownership* and *GDP growth* is 0.0155. According to Kennedy (2008), multicollinearity is a critical issue when the correlation is higher compared to 0.8. Therefore, it can be indicated that no strong correlation exists among independent variables, and the multicollinearity does not occur in regression models.

3.3 Regression results

Hausman test

The Hausman test is developed to give assistance in deciding on electing between the fixed effects and random effects approach. The hypotheses of the Hausman test are:

H0: Random effects are consistent and efficient

H1: Random effects are inconsistent (fixed effect will be always consistent)

The F-test is adopted to test the hypotheses. When the p-value is greater compared to 0.5, the null hypothesis should not be rejected, implying the choice of random effect. Adversely, when the p-value is smaller compared to 0.5, the null hypothesis should be rejected, which indicates that fixed effect should be employed when regressing models.

Fig 1. Hausman test

```
Test:  Ho:  difference in coefficients not systematic

              chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       14.90
            Prob>chi2 =      0.0372
```

Fig 1. presents the result for Hausman test that provide assistance in deciding on electing between the fixed effects and random effects approach for model 1. The p-value is found to be smaller compared to 0.1. Hence, the null hypothesis can be rejected, suggesting the utilization of fixed effect for model 1.

Fig 2. Hausman test

```
Test:  Ho:  difference in coefficients not systematic

              chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       16.11
            Prob>chi2 =      0.0241
```

Fig 2. reports the result for Hausman test assisting for an election between the fixed effect and random effect approach for model 2. It is indicated the p-value is smaller compared to 0.1. Thus, the null hypothesis can be rejected, recommending the adoption of fixed effect for model 2.

Consequently, according to the findings of Hausman test for model 1 and model 2, fixed effect approach is employed when regressing the models in order to provide assessment of the relation between capital and profitability of bank.

The impact of bank capital on profitability

Tab 3. Panel data regression of capital and profitability of bank

	ROA	NIM
VARIABLES	(1)	(2)
Capital	6.8951*	13.0654**
	(3.5119)	(5.8857)
Deposit growth	-0.0017*	-0.0066*
	(0.0010)	(0.0035)
Size	0.5921**	0.3207
	(0.2668)	(0.7510)
Funding cost	1.6837	4.4535
	(1.3030)	(4.3237)
Ownership	0.0571	0.3766
	(0.0992)	(0.2272)
GDP growth	16.9172	35.5503
	(10.8046)	(21.0038)
Inflation	6.0850***	10.9472**
	(1.8701)	(4.8954)
Lend	-0.4775	-0.7003
	(0.3705)	(1.1126)
Constant	-20.0969**	-11.0275
	(8.8079)	(23.7202)
Bank fixed effect	YES	YES
R-squared	0.2633	0.3127

Observations	177	177
Note: Robust standard errors in parentheses Significant level: * p < 0.1, ** p < 0.05, *** p < 0.01		

In order to explore the impact of capital on profitability of banks, panel data regressions models with bank fixed effect approach as suggested by Hausman test are employed. The regressions are run respectively for each measure of profitability: *ROA* and *NIM*. The findings of regression models are provided in *Table 4.3*.

The estimated coefficients on *Capital* for models with *ROA* and *NIM* as dependent variable are statistically significant as well as has value of 6.8951 and 13.0654, respectively. This means that if *Capital* changes by 1 unit, it would raise *ROA* and *NIM* by 6.8951 and 13.0654 respectively, with the assumption that the other factors remain unchanged. The sign of these coefficients provides evidences of positive impact of bank capital on *ROA* and *NIM*, which are similar to the results of Lee and Hsieh (2013); Dietrich and Wanzenried (2011). As explained above, highly capitalized banks experience great profitability since they have high creditworthiness, involve in prudent lending, and have less demand for external funding. Moreover, capital is considered as a tool to help banks protect themselves against risk and enhance the management quality, which ultimately enable banks to generate higher earnings.

In term of bank internal factors, the estimated coefficients on *Funding cost* and *Ownership* are not significant for all three models, suggesting that the cost of funding and ownership status of bank do not have impact on banks' profitability. However, growth of deposit of banks significantly affects their profitability. It is found that the estimated coefficient on *Deposit growth* is -0.0017 and -0.0066 for models with ROA and NIM as dependent variable, respectively. This suggests that rise in deposit exerts a negative effect on *ROA* and *NIM*. As explained above, the growth in deposit might associated with the investment in lower credit quality assets and attraction of additional market competitors, which thereby negatively influence profitability of bank. Further, there is a positive estimated coefficient on size of bank, yet size has significant influence on ROA only. Banks with large size could experience lower risk, greater economies of scale as well as have capability of accessing less expensive capital in comparison with small-sized banks. Given this, larger the bank size will lead to higher profitability.

Regarding to macroeconomics factors, the results show that inflation significantly and positively affects both *ROA* and *NIM* as the value of estimated coefficient of *Inflation* for model 1 and 2 are 6.0850 and 10.9472, respectively. This indicates that the increase in inflation will help elevate banks' profitability. By contrast, *GDP growth* and *Lend* appear to have insignificant effect on bank profitability.

The values of R-squared for model 1 and 2 are 26.33% and 31.27%.

The impact of bank capital on profitability across different size classes

Tab 4. Panel data regression of capital and profitability of bank across different size classes

	Small-size banks			Large-size banks	
	ROA	NIM		ROA	NIM
VARIABLES	(1)	(2)		(3)	(4)

Capital	9.4572*	17.8758*		10.2962	4.0308
	(4.5907)	(9.3815)		(8.9367)	(7.9679)
Deposit growth	-0.0012	-0.0040		-0.0023	-0.0051
	(0.0014)	(0.0038)		(0.0023)	(0.0031)
Size	1.1496**	0.9625		0.4524	-1.2965**
	(0.4129)	(1.2191)		(0.3870)	(0.5417)
Funding cost	1.2964	0.9711		3.4993	12.0451***
	(1.5829)	(4.6401)		(2.5250)	(3.7506)
Ownership	0.1777*	0.0807		0.1296	0.1636
	(0.0988)	(0.2735)		(0.1613)	(0.2701)
GDP growth	19.0267	40.7089		20.8686	33.5863
	(14.2035)	(33.5456)		(16.3988)	(35.1138)
Inflation	8.2603***	16.7749*		4.4336	2.8341
	(2.4207)	(9.1398)		(2.9882)	(7.2525)
Lend	-0.8506	-1.0988		-0.4704	0.9332
	(0.5171)	(1.7194)		(0.5375)	(1.2955)
Constant	-37.3817***	-31.6155		-16.3078	41.5735**
	(12.8197)	(37.5093)		(13.6432)	(17.5756)
Bank fixed effect	YES	YES		YES	YES
R-squared	0.4049	0.4103		0.1836	0.4138
Observations	89	89		88	88
Note: Robust standard errors in parentheses Significant level: * p < 0.1, ** p < 0.05, *** p < 0.01					

In this section, following previous literature (Slovin, 1992), the sample is further divided into two subsamples according to the medium of commercial banks' size in order to assess whether there is difference in the influence of capital on profitability across diverse size classes. The regression findings are provided in Table 4 Column 1-2 show the results for small banks (size equal or smaller the median size of all commercial banks). Column 3-4 present the results for large banks (size larger than the median size of all commercial banks).

The regression results demonstrate that Capital imposes a consistently positive and significant influence on profitability of small-size banks. By contrast, Capital appears to exert no visible effect on profitability of banks

possessing large size. These results are consistent with prior study of Berger and Bouwman (2013), which indicates that in normal times, capital helps enhance the profitability of small banks.

A possible interpretation is under the circumstance of banks with large size, size might be considered as a source of economic strength for them, similarly to capital, and that each has reducing marginal value. Moreover, large banks are able to depend on financial market access and correspondent as well as other interbank relation besides their on-balance-sheet capital so as to enhance performance (Berger and Bouwman, 2013). Hence, the profitability of banks with large size will not be affected by their capital. On the other hand, for small banks, higher capital ratio is related to greater profitability. As discussed by Berger and Bouwman (2013) capital is important for small banks since they encounter shocks more often compared to large-sized banks and capital can act as a vital mechanism of defense against their damaging shocks. Additionally, small banks also experience constrained and relatively expensive access to the financial market in comparison with large banks. Possessing a high capital-to-asset ratio might help these banks increase their creditworthiness and then reduce funding cost as well as the demand for external funding (Dietrich and Wanzenried, 2011), which thereby elevate the performance.

Other controls variables also provide additional important insights. Initially, bank size imposes a significant and beneficial effect on return on assets (ROA) of small banks, whereas its influence on net interest margin (NIM) of large-sized banks is significantly negative. Further, *Funding cost* only positively influence NIM of banks that have large size. Finally, while there is a positive effect of *Ownership* on ROA only, the inflation rate exerts a positively significant impact on both net interest margin and return on assets of small banks.

Almost all value of R-square is over 40%, except for the regression model 3 whose R-squared is only around 18.3%

The impact of bank capital on profitability across different type of ownership

Tab 5. Panel data regression of capital and profitability of bank across different type of ownership

	State-owned		Private-owned	
	ROA	NIM	ROA	NIM
VARIABLES	(1)	(2)	(3)	(4)
Capital	0.8309	19.8495**	7.4953*	12.9672**
	(2.5005)	(8.6854)	(3.7948)	(6.2693)
Deposit growth	0.0016	-0.0010	-0.0016	-0.0069*
	(0.0038)	(0.0056)	(0.0010)	(0.0036)
Size	1.0287	0.8205	0.6984**	0.2589
	(0.6098)	(0.7397)	(0.3020)	(0.8887)
Funding cost	9.2056***	29.5045***	1.3038	3.1340
	(1.5109)	(3.7798)	(1.3344)	(4.3319)

GDP growth	-7.7588	-12.7972	20.5949	49.0012*
	(12.3894)	(20.5510)	(12.9201)	(26.2467)
Inflation	-1.3858	-7.6994**	7.3287***	14.1095**
	(1.7078)	(3.5311)	(2.1104)	(5.9353)
Lend	-1.6560	0.2874	-0.6013	-0.8866
	(1.1633)	(1.9291)	(0.4227)	(1.2274)
Constant	-31.9226	-26.8554	-23.5833**	-9.6636
	(19.0348)	(23.5578)	(9.9135)	(27.8292)
Bank fixed effect	YES	YES	YES	YES
R-squared	0.5940	0.8218	0.2805	0.3105
Observations	36	36	141	141

Note: Robust standard errors in parentheses
Significant level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In order to provide a more in-depth examination on the effect that capital impose on bank profitability, in this subsection, the sample is further divided into two subsamples, which are state-owned banks and private-owned banks. Table 5 provides the results for regression models. Column 1-2 show the results for state-owned banks, whereas column 3-4 present the results for privately owned banks. According to the regression results, signs of estimated coefficients on *Capital* are found to be in line with the main result, which indicate that the influence that capital exert on profitability of bank is positive. This impact is significant for ROA and NIM of private-owned banks and NIM of state-owned banks, however, for ROA of banks possessed by the government, this impact is insignificant. A possible reason for this outcome is that the government-owned banks might enjoy benefits from some sort of the government guarantee. It is believed that state-owned banks are strongly protected by the government. Faccio et al. (2006), analyzing the tendency of the government bailouts of 450 politically related firms from 35 nations from 1997 to 2002, indicate that politically related firms tend to be bailed out compared to similar non-related firms. Arguably, if the government, as the owner of the banks, has responsibility for a bank's solvency, the intervention of the government is higher. Moreover, because of the strong protection that the government provides, state-owned banks experience lesser default risk compared to other banks. Indeed, Brown and Dinç (2011), examining failure of bank in 21 emerging market nations in 1990s, provide evidence that it less popular for banks owned by the government encounter default risk. As state-owned banks are likely to enjoy the advantages provided by the government, the earning of government-owned banks probably is not influenced by the level of their capital ratios, which thereby lead to the insignificant impact of capital on income to assets ratio. Nevertheless, the net interest margin of the government-owned banks is significantly affected by their equity-to-asset ratio. As it is argued that high capitalized banks normally have less demand for external funding, borrow less as well as possess the capability of engaging in prudent lending, they might able to have higher NIM in comparison with those have low capital level. With regard to other explanatory variables, growth of deposit appears to have a negatively significant effect on NIM of private banks. By contrast, bank size exerts a positive effect on ROA of private banks. While *Funding cost* significantly and positively influence ROA and NIM of state-owned banks, *GDP growth* only impose a significantly positive effect on NIM of private banks. The inflation rate significantly

and negatively affects NIM of the government-owned banks, whereas its influence on ROA as well as NIM of privately-owned banks is positive. The values of R-squared for four models are around 59.40%, 82.18%, 28.05%, and 31.05%, respectively.

Discussion of results

The aim of the research is to provide investigation of the impact of capital on bank profitability over the period 2012-2017. To obtain this objective, the panel data regression model is employed. Particularly, in this research, the main regression results are provided by fixed effect approach. According to the findings of Hausman test in section 4.2.1, the fixed effect method is selected as an appropriate approach to estimate regression models. Therefore, this section will discuss the results of panel data fixed effect approach in order to provide a useful examination of the association between capital and profitability of bank. Based on the panel regression models which are presented in chapter 3, the influence of capital as well as other factors on bank profitability have been examined. The most remarkable outcome is that the rise in capital level results in the growth of bank profitability. This result is not only in line with a positive linkage among capital with and bank profitability which is investigated in previous empirical literatures in Asia for example: Lee and Hsieh (2013); but also consistent with prior researches in the world, for example: Chortareasa et al. (2012), Iannotta et al. (2007); Demirgüç-Kunt and Huizinga (2000). So as to elevate the stability and quality as well as promote development of banking sector, the State Bank of Vietnam has released the circular 41/2016/TT-NHNN which requires Vietnamese commercial banks to strictly follow the Basel II standard method. This requirement is expected to enhance the capital ratio of commercial banks and thereby improve their financial outcome. Indeed, capital is investigated to be an effective tool for bank to reduce risk, increase operating efficiency as well as profitability (i.e., Lee and Hsieh, 2013; Tan and Floros 2013; Fiordelisi et al., 2011; Chortareasa, 2012; Sufian, 2010; Mehran and Thakor, 2011). According to Tan (2016), highly capitalized banks are likely to possess high creditworthiness, which helps them attract a lot of customers and especially big customers. Additionally, the high tendency to engage in prudent lending of these banks might lead to lower level of bank risk. Capital also serves as an important mechanism which reduces bank risk coming from asset with higher risk such as loans. As a result, more capitalized banks tend to have lower level of bankruptcy cost (Berger, 1995) as well as high likelihood of survival (Berger and Bouwman, 2013). Further, when banks hold the high degree of capital ratio, they will possess ability to borrow less, which subsequently decrease their cost and boost the profitability. Eventually, it is indicated that banks with high capital level experience better management quality, therefore, they are able to possess high income and low cost (Iannotta et al., 2007). Consequently, the findings of regression models strongly suggest that enhancing capital ratio (measured by equity-to-assets ratio) is extremely necessary, and Vietnamese commercial banks should improve level of capital to elevate their financial performance. Besides the main results, this study also provides a more in-depth analysis by dividing the sample into subsample based on unique attributes of commercial banks, namely, bank size and type of ownership. It is found the findings are vary across different ownership status and classes of bank size. First, regarding to the size of bank, the effect that capital imposes on bank profitability is more pronounced in the situation of small-sized banks, whereas this impact is insignificant for banks with large size. More specifically, the profitability of small banks is positively influenced by higher level of capital, in other words, small banks which are highly capitalized are capable of experiencing greater profitability. For the case of large-sized banks, it is considered that size might be a source of economic strength. Moreover, banks with large size have ability of taking advantage of easy access to financial market as well as interbank relation in order to improve their performance instead of utilizing own capital (Berger and Bouwman, 2013). Thus, the level of capital might not exert significant effect on large banks. Nevertheless, in the circumstance of small-sized banks, these banks are more likely to encounter shock in comparison with large-sized banks, thus, they need to possess high capital ratio so as to prevent themselves against detrimental shocks (Berger and Bouwman, 2013). Further, compared to large banks, small banks experience more constrains and expensively access to financial market. With a high capital to

assets ratio, these banks are able to enhance creditworthiness and then diminish the limitation of accessing financial market, which thereby elevate financial outcome. Second, with respect to type of ownership, both return on assets and net interest margin of private banks are affected by capital. However, to banks owned by the government, only net interest margin is influenced. The possible reason for this is that state-owned banks are likely to enjoy the preferences and advantages that provide by the government; therefore, their performance might not be influenced by capital level. Indeed, state-owned banks are strongly protected by the government (Faccio et al., 2006), which helps them avoid encountering default risk (Brown and Dinç, 2011). As a result, the earnings of banks owned by the government is not influenced by capital level, which ultimately leads to the insignificant impact of capital on state-owned banks' return on assets. Addition to capital, there are numerous variables are utilized as determinants of commercial bank profitability. They are Deposit growth, Size, Funding cost, Ownership, GDP growth, Inflation, and Lend. The findings state that three out of seven variables significantly affect profitability of Vietnamese commercial bank. Initially, Deposit growth is found to have negative association with bank profitability. This result is supported by the explanation of Dietrich and Wanzenried (2011) that growth in deposit might be obtained by financing with assets with lower credit quality. Furthermore, higher development rate may draw the attention of additional competitors, which reduces the profitability of all participant in the market. Therefore, growth in deposit probably exerts a detrimental impact on bank profitability. Secondly, the correlation between bank size and return on assets is positive. This finding is consistent with the findings of a number of previous studies (i.e., Smirlock, 1985; Dietrich and Wanzenried, 2011; Short, 1979). Banks with large size possess capability to experience great product level and diversification in loans as well as high economies of scale (Dietrich and Wanzenried, 2011). Also, these banks have tendency to raise cheaper capital in comparison with other banks. Accordingly, there is a beneficial impact of size on bank return on assets. Thirdly, it is found that there is a significantly positive association between inflation and bank profitability. This implies that banks' manager might be capable of predicting the inflation rate and then adjust their interest rate at an appropriate value that is helpful in fostering their revenues faster in comparison with cost, which thereby achieve higher profits (Perry, 1992).
Four other control variables, namely Funding cost, Ownership, GDP growth, and Lend, are indicated to impose insignificant influence on profitability of commercial bank. Although these the results do not support prior empirical findings, it does not mean that previous findings are not appropriate. The influences of these variables on bank profitability are insignificant in the chosen period probably be consequence of the unique context of Vietnam economy in the examined period.

In conclusion, the vital conclusion reached from the panel data regression models' empirical results is that there are statistically significant evidences that high-level capital promotes the financial performance, particularly profitability, of bank during the period between 2012 and 2017.

4. Conclusion

This research assesses the relation between bank capital and profit, using data at bank-level of 30 Vietnamese commercial banks from 2012 to 2017. This research applies recent panel data techniques. The regression findings imply that the increase in bank capital is significantly and positively associated with profitability. It is also explored that dissimilar profitability variables have identical results on the persistence of profit. A possible reason for this positive relationship is that highly capitalized banks tend to have high creditworthiness, involve in prudent lending, and have less demand for external funding, which ultimately enable them to enhance profitability. Further, high level of capital helps banks protect themselves against risk and generate higher earnings.

References

Albertazzi, U., and Gambacorta, L., 2009. Bank profitability and the business cycle. *Journal of Financial Stability*, 5(4), pp.393-409.

Asteriou, D., & Hall, S. G.(2011). Applied econometrics. New York: Palgrave Macmillan
Altunbas, Y., Carbo, S., Gardener, E.P. and Molyneux, P., 2007. Examining the relationships between capital, risk and efficiency in European banking. *European Financial Management*, 13(1), pp.49-70.
Berger, A.N. and Bouwman, C.H., 2017. Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability*, 30, pp.139-155.
Berger, A.N., 1995. The relationship between capital and earnings in banking. *Journal of money, credit and Banking*, 27(2), pp.432-456.
Berger, A.N., Hanweck, G.A. and Humphrey, D.B., 1987. Competitive viability in banking: Scale, scope, and product mix economies. *Journal of monetary economics*, 20(3), pp.501-520.
Bitar, M., Pukthuanthong, K. and Walker, T., 2018. The effect of capital ratios on the risk, efficiency and profitability of banks: Evidence from OECD countries. *Journal of International Financial Markets, Institutions and Money*, 53, pp.227-262.
Bourke, P., 1989. Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking & Finance*, 13(1), pp.65-79.
Bikker, J.A. and Hu, H., 2002. Cyclical patterns in profits, provisioning and lending of banks and procyclicality of the new Basel capital requirements. *PSL Quarterly Review*, 55(221).
Brewer III, E. and Lee, C.F., 1986. How the market judges bank risk. Federal Reserve Bank of Chicago Economic Perspectives, 10(6), pp.25-31.
Bikker, J.A. and Hu, H., 2002. Cyclical patterns in profits, provisioning and lending of banks and procyclicality of the new Basel capital requirements. *PSL Quarterly Review*, 55(221).
Brown, C.O. and Dinç, I.S., 2011. Too many to fail? Evidence of regulatory forbearance when the banking sector is weak. *The Review of Financial Studies,* 24(4), pp.1378-1405.
Calomiris, C.W. and Mason, J.R., 2003. Consequences of bank distress during the Great Depression. *American Economic Review*, 93(3), pp.937-947.
Chortareas, G.E., Girardone, C. and Ventouri, A., 2012. Bank supervision, regulation, and efficiency: Evidence from the European Union. *Journal of Financial Stability*, 8(4), pp.292-302.
Demirgüç-Kunt, A. and Huizinga, H., 1999. Determinants of commercial bank interest margins and profitability: some international evidence. *The World Bank Economic Review*, 13(2), pp.379-408.
De Guevara, J.F., Maudos, J. and Pérez, F., 2007. Integration and competition in the European financial markets. *Journal of International Money and Finance*, 26(1), pp.26-45.
Demirguc-Kunt, A., Detragiache, E. and Merrouche, O., 2013. Bank capital: Lessons from the financial crisis. *Journal of Money, Credit and Banking*, 45(6), pp.1147-1164.
Diamond, D.W. and Rajan, R.G., 2000. A theory of bank capital. *The Journal of Finance,* 55(6), pp.2431-2465.
Dietrich, A. and Wanzenried, G., 2011. Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money*, 21(3), pp.307-327.
Faccio, M., Masulis, R.W. and McConnell, J.J., 2006. Political connections and corporate bailouts. *The Journal of Finance*, 61(6), pp.2597-2635.
Fiordelisi, F., Marques-Ibanez, D. and Molyneux, P., 2011. Efficiency and risk in European banking. *Journal of Banking & Finance*, 35(5), pp.1315-1326.
Goddard, J., Molyneux, P. and Wilson, J.O., 2004. The profitability of European banks: a cross-sectional and dynamic panel analysis. *The Manchester School,* 72(3), pp.363-381.
Golin, J. and Delhaise, P., 2013. The bank credit analysis handbook: a guide for analysts, bankers and investors. John Wiley & Sons.
Iannotta, G., Nocera, G. and Sironi, A., 2007. Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance*, 31(7), pp.2127-2149.
Jahankhani, A. and Lynge, M.J., 1979. Commercial bank financial policies and their impact on market-determined measures of risk/BEBR No. 556. Faculty working papers; no. 556.
Kennedy, P., A guide to econometrics. 2008. Malden, MA: Blackwell.
Kim, M., Kristiansen, E.G. and Vale, B., 2005. Endogenous product differentiation in credit markets: What do borrowers pay for? *Journal of Banking & Finance*, 29(3), pp.681-699.
Mayne, L.S., 1972. Supervisory influence on bank capital. *The Journal of Finance*, 27(3), pp.637-651.
Mehran, H. and Thakor, A., 2011. Bank capital and value in the cross-section. *The Review of Financial Studies*, 24(4), pp.1019-1067.
Modigliani, F. and Miller, M.H., 1963. Corporate income taxes and the cost of capital: a correction. *The American economic review*, 53(3), pp.433-443.
Molyneux, P. and Thornton, J., 1992. Determinants of European bank profitability: A note. *Journal of banking & Finance*, 16(6), pp.1173-1178.
Micco, A., Panizza, U. and Yanez, M., 2007. Bank ownership and performance. Does politics matter? *Journal of Banking & Finance*, 31(1), pp.219-241.
Lee, C.C. and Hsieh, M.F., 2013. The impact of bank capital on profitability and risk in Asian banking. *Journal of international money and finance*, 32, pp.251-281.

Pasiouras, F. and Kosmidou, K., 2007. Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance*, 21(2), pp.222-237.

Perry, P., 1992. Do banks gain or lose from inflation? *Journal of Retail Banking*, 14(2), pp.25-31.

Revell, J., 1979. Inflation & Financial Institutions. Financial Times Limited.

Rime, B., 2001. Capital requirements and bank behaviour: Empirical evidence for Switzerland. *Journal of Banking & Finance*, 25(4), pp.789-805.

Pettway, R.H., 1976. Market tests of capital adequacy of large commercial banks. *The Journal of Finance*, 31(3), pp.865-875.

Shrieves, R.E. and Dahl, D., 1992. The relationship between risk and capital in commercial banks. *Journal of Banking & Finance*, 16(2), pp.439-457.

Short, B.K., 1979. The relation between commercial bank profit rates and banking concentration in Canada, Western Europe, and Japan. *Journal of Banking & Finance*, 3(3), pp.209-219.

Slovin, M.B., Johnson, S.A. and Glascock, J.L., 1992. Firm size and the information content of bank loan announcements. *Journal of Banking & Finance,* 16(6), pp.1057-1071.

Smirlock, M., 1985. Evidence on the (non) relationship between concentration and profitability in banking. *Journal of money, credit and Banking*, 17(1), pp.69-83.

Stiroh, K.J. and Rumble, A., 2006. The dark side of diversification: The case of US financial holding companies. *Journal of banking & finance*, 30(8), pp.2131-2161.

Staub, R.B., e Souza, G.D.S. and Tabak, B.M., 2010. Evolution of bank efficiency in Brazil: A DEA approach. *European journal of operational research*, 202(1), pp.204-213.

Sufian, F., 2010. The impact of risk on technical and scale efficiency: empirical evidence from the China banking sector. *International Journal of Business Performance Management*, 12(1), pp.37-71.

Tan, Y. and Floros, C., 2012. Bank profitability and inflation: the case of China. *Journal of Economic Studies*, 39(6), pp.675-696.

Tan, Y., 2016. The impacts of risk and competition on bank profitability in China. *Journal of International Financial Markets, Institutions and Money*, 40, pp.85-110.

Vu, H. and Nahm, D., 2013. The determinants of profit efficiency of banks in Vietnam. *Journal of the Asia Pacific Economy*, 18(4), pp.615-631.