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Adjustment of Bank Capital Ratios:
New Evidence From Commercial Banks

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ABSTRACT

This study explores the speed of adjustment of the capital ratio, regulatory ratio, and tier- I ratio of commercial banks in China by employing the GMM framework from 2006 to 2020. The empirical analysis reveals that banks adjust their regulatory ratio and tier-I ratio faster than the capital ratio of Chinses commercial banks. The findings report that the pace of regulatory ratio, a tier-I ratio of well-capitalized, highly liquid, and high growth banks are faster than under-capitalized, low liquid and low growth commercial banks in China. In addition, the speed of adjustment of regulatory ratio, the tier-I ratio is faster than capital ratio during the GFC-2008 in China. These findings suggest that the regulators may consider the heterogeneity in the speed of capital adjustment across different bank characteristics to formulate new bank regulations; particularly, when assessing and adjusting the specific capital requirements through Pillar II of the Basel III agreement.

KEYWORDS

Capital ratio, Regulatory ratio, Speed of Adjustment, Tier-I ratio

1. INTRODUCTION

The Global Financial Crisis (GFC) of 2008 exposed the global banking system's vulnerabilities. It emphasized the critical role of risk-weighted capital reserves and capital buffers in mitigating risk and sustaining economic growth during times of economic instability. The causes and consequences of the GFC-2008 also emphasized the importance of a stable and robust banking system capable of coping with unanticipated financial and economic instability. Therefore, after the GFC-2008 Basel Committee revised the mechanism for banks to establish capital ratios during the up and downturn economic conditions as a precaution for future unexpected economic events (Abbas, Ali, & Rubbaniy, 2021). This new mechanism of Basel-III for holding and managing bank capital indicates that each bank requires adjusting its capital ratios. As the second-largest economy globally, China has one of the largest banking industries on the globe. In the past decade, the China Banking Regulatory Commission has implemented the Basel-III recommendations for the minimum capital requirement of 8% for their commercial banks (Huang & Xiong, 2015).

A rapidly growing literature analyzes different elements of the Basel-III recommendations for banks (Agoraki, Delis, & Pasiouras, 2011; Barth, Lin, Ma, Seade, & Song, 2013; Borio & Zhu, 2012;

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Bougatef & Mgadmi, 2016). In a particular context, Brandao-Marques, Correa, and Sapriza (2018) explore the role of regulations and bank risk-taking, Chalermchatvichien, Jumreornvong, and Jiraporn (2014) investigate the Basel-III, capital stability, risk-taking and ownership in Asian banking, and Chi and Li (2017) probe the economic policy uncertainty, credit risk and lending decision in China. Chiaramonte and Casu (2017) provide evidence for bank capital and liquidity for European banks, (Ding & Sickles, 2018, 2019) explore the frontier efficiency, capital structure, and portfolio risk of US banks. However, one part of the banking literature that is still absent is how banks change their needed capital ratios following an economic downturn. Furthermore, the speed of the adjustment process to achieve their target capital and variables contributing significantly to the capital adjustment process in the banking sector is also critical topics brought to researchers' attention. Although a few studies (Abbas et al., 2021; Bakkar, De Jonghe, & Tarazi, 2019; De Jonghe & Öztekin, 2015) have investigated the process of capital adjustment for banks but the evidence is still scant and inconclusive. To fill this gap the study attempts to address the following questions: Does the speed of adjustment varies across different types of capital ratios? How does the speed of capital adjustment vary across different levels of the factors for instance banks' capitalization, liquidity, growth, and economic conditions in China?

Our empirical analysis reveals that Chinese banks adjust their regulatory and tier-I ratios faster than their capital ratio. The results support that the speed of adjustment of various capital ratios of well capitalized, under-capitalized, high and low growth and high and low liquid banks of Chinese banks is heterogeneous. The findings report that the pace of regulatory ratio, a tier-I ratio of under-capitalized banks, is lower than well-capitalized banks. Similarly, the speed of regulatory ratio and the tier-I ratio of high liquid banks are quicker than low liquid banks. The rate of adjustment of regulatory ratio and the tier-I ratio of high-growth banks is faster than the adjustment of capital ratio. In addition, the speed of adjustment of regulatory ratio, the tier-I ratio is faster than capital ratio during the GFC-2008 in China.

This study contributes to the existing literature in a few ways. First, the study provides empirical evidence on the speed of capital adjustment using capital ratios, Tier-I ratios, and regulatory ratios, where the work is new in Chinese commercial banks' context. Second, the study investigates the speed of adjustment for well-capitalized and under-capitalized commercial banks, where the evidence is missing in China's context. Third, the study examines the pace of capital ratios for high and low liquid commercial banks in China, which has never been discussed in the existing literature. Fourth, the study provides empirical evidence on the speed of adjustment for high and low-growth Chinese banks. Fifth, the study investigates the role of GFC in the adjustment process of bank capital ratios. Finally, the findings have valued implications for regulators to devise new regulations for adjusting capital ratios. For instance, the results of the study suggest that the regulators may consider the heterogeneity in the speeds of capital adjustment of banks with varying capitalization, liquidity, growth and GFC-2008 for the formulation of new regulations; particularly, for analyzing and revising specific capital requirements following Pillar II of the Basel III agreement.

The remainder of the study is organized as follows: Section 2 analyzes the literature review and formulates hypotheses. Section 3 details the study's research design and methods. Section 4 interprets the analysis, and Section 5 contains the conclusion, policy implications, and study limitations.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Growing theoretical and empirical literature provides support for the presence of an optimal capital ratio (Abbas et al., 2021; Flannery & Rangan, 2008). The most recent and seminal study of Abbas et al. (2021) in the USA concludes that large commercial banks adjust their regulatory capital ratios faster than their traditional capital ratios. Bakkar et al. (2019) investigate the speed of capital adjustment of OECD economies listed banks over the period 2001 to 2012. The study provides evidence that banks adjust their capital ratio faster than regulatory capital ratios in OECD countries. (De Jonghe &

Öztekin, 2015; Lepetit, Saghi-Zedek, & Tarazi, 2015) investigate the adjustment sources of banks' capital globally. The study concludes that banks primarily use equity to restore their target capital ratio instead of the sale of assets liquidation. The study confirms that the higher and stringent capital regulations increase the speed of adjustment of banks. The findings of Jokipii and Milne (2008) provide evidence that European banks take two-third of their yearly gap between present and the desire capital level. Shimizu (2015) investigate the speed of adjustment of numerator and denominator of their capital ratios. The study concludes that Japanese banks adjust their regulatory ratios faster than non-regulatory capital ratios. The results provide evidence that banks reduce their higher risky assets instead of decreasing their total assets. The outcomes of Abbas and Masood (2020b) study concluded that commercial banks adjust their regulatory capital ratios faster than non-regulatory capital ratios in the USA. Despite the availability of relevant literature on capital adjustments, the studies comparing the pace of capital adjustment of regulatory ratio and tier-I ratio with a capital ratio of the Chinese banks are missing. Since the China banking industry is the most extensive globally, it is significant to explore how quickly Chinese banks adjust their capital ratio, regulatory ratio and tier-I ratio. Our first hypothesis is as follows from these observations:

H_{01}: Chinses banks adjust their regulatory ratio, tier-I ratio quicker than their capital ratio.

Abbas et al. (2021) reveal that US too-big-to-fail banks speed of adjustment of regulatory capital ratios is lower than well-capitalized, adequately capitalized banks. The results also confirm that the speeds of adjustment of nationally charted and state-chartered banks are not similar. The results of Abbas and Masood (2020a) study conclude that well-capitalized banks use lesser time than adequately capitalized banks to restore their equilibrium capital ratios. In a similar context, under-capitalized banks take higher time than those of adequately capitalized banks to achieve their target capital ratios in the USA. The results of (Jokipii & Milne, 2008; Memmel & Raupach, 2010) confirm that capital adjustment speed is significantly higher for financial firms than non-financial firms in Europe. Abbas and Masood (2020b) opine in their study, under-capitalized banks adjuster their risk-based capital ratio faster than well-capitalized and adequately capitalized banks in the US. Drobetz and Wanzenried (2006) explore the speed of adjustment to target capital ratio by using the data set of 90 Swiss firms from 1991 to 2001. They argue that capital adjustment and cost of adjustment are interdependent. The results show that high-growth firms adjust their capital ratios faster than lower-growth firms in Switzerland. Existing research on the speed of capital adjustment for various levels of bank capitalization is unclear and limited. Furthermore, studies on the rate of capital adjustment for various levels of bank liquidity and bank growth are rare. These observations have led us to form the following hypothesis:

H_{02}: Speed of adjustment of regulatory ratio, tier-I ratio and the capital ratio varies with the level of capitalization, liquidity and growth of banks.

Abbas et al. (2021) report that the speed of adjustment of regulatory capital ratios is higher in the post-crisis period than in the pre-crisis period. Abbas and Masood (2020a) investigate and conclude that the US commercial banks adjust their leverage ratio faster in the post-crisis period than a pre-crisis ear. Cohen and Scatigna (2016) argue that banks with higher capital can come out more readily and lend more to earn higher profits. The results of Shimizu (2015) study indicate that macroeconomic conditions influence the speed of adjustment of denominator and numerator capital ratios in Japan. Drobetz and Wanzenried (2006) explore the speed of adjustment to target capital ratio by using the data set of 90 Swiss firms from 1991 to 2001. They argue that capital adjustment and cost of adjustment are interdependent. The findings reveal the interrelationship between the speed of adjustment and macroeconomic variables (business cycle). Abbas and Masood (2020b) conclude that

commercial banks' speed of adjustment is faster in the post-crisis period than pre and during crisis periods in the USA. The preceding literature review suggests that market conditions influence the speed of capital adjustment; nonetheless, the results are contradictory and inconclusive, prompting us to construct the following hypothesis:

H_{03}: Chinese banks adjust their regulatory ratio and tier-I ratio faster than the capital ratio during a crisis period.

3. METHODOLOGY AND ECONOMETRIC MODEL

3.1 Data

To study the speed of adjustment of bank capital ratio, regulatory ratio, and tier-I ratio in the Chinese banking industry, we developed panel data for commercial banks from 2006 to 2020. The bank-specific variables data is collected from BankFocus (formerly known as Bankscope). BankFocus is a global banking database. In addition to the confirmation and validity of data, banks' annual reports are also used. Moreover, the data for economic growth and inflation rate is collected from World Bank's World Bank's World Development Indicators (WDI). The banks that have missing data for more than three years are not included in our sample. Therefore, we collect the data for 105 Chinese commercial banks. Our sample consists of all larger banks in China, including major state-owned banks, joint-stock banks and city commercial banks, comprising an average of over 80% of the banking industry portfolio of business. Therefore, our data set is the comprehensive and true representative of Chinas' banking industry over the specified period. This permits us to explore the speed of adjustment of capital ratio, regulatory ratio and tier-I ratio for well-capitalized, under-capitalized, high and low liquid and high and low growth commercial banks in China.

3.2 Econometric Model

Following previous studies (Abbas & Masood, 2020b; Bakkar et al., 2019), we develop a model to investigate the speed of adjustment of regulatory ratio, tier-I ratio and capital ratio of Chain's commercial banks as follows:

$$\text{Capital ratio}_{i,t} = \gamma\ \text{Capital ratio}_{i,t}^{*} + (1-\gamma)\ \text{Capital ratio}_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

Here Capital ratio $_{i,t}$ shows capital ratio of bank i in time t; Capital $\text{ratio}_{i,t}^{*}$ indicates the target capital ratio of bank i in time t; Capital ratio $_{i,t-1}$ stands for the capital ratio of bank i in time t-1. Each year, a typical bank in China closes a proportion γ of the gap between its actual and target capital levels. The smaller the value of γ the more rigid the capital ratio is, and the longer time bank requires to achieve its required capital ratio after a shock occurs in an economy. Thus, we can interpret γ as the speed of adjustment and its complement (1- γ) as the portion of capital that is inertial.

In Equation (1), bank's target capital ratio $\text{Capital ratio}_{i,t}^{*}$ is unknown and varies both over time and cross-section. This target capital ratio is based on a linear trend of the lagged ratio of capital, characteristics of bank, and time-fixed factors. Following recent studies (Abbas et al., 2021; Bakkar et al., 2019) we explore these attributes in the following model:

$$\text{Capital ratio}_{i,t}^{*} = \alpha_0 + \beta_1\ \text{Capital ratio}_{i,t-1} + \beta_2\ \text{Profitability}_{i,t} + \beta_3\ \text{Liquidity}_{i,t} + \beta_4\ \text{Loan growth}_{i,t} + \beta_5\ \text{Size}_{i,t} + \beta_6\ \text{Bank risk}_{i,t} + \beta_7\ \text{Efficiency}_{i,t} + \beta_8\ \text{Economic growth}_{i,t} + \beta_9\ \text{Inflation}_{i,t} + V_t + u_i \quad (2)$$

Here $\text{Capital ratio}_{i,t}^{*}$ shows the target capital ratio of bank i in time t; $\text{Capital ratio}_{i,t-1}$ stands for the capital ratio of bank i in time t-1. $\text{Profitability}_{i,t}$ is the ratio of net income to total assets of bank

i in time t; $Liquidity_{i,t}$ is the ratio of liquid assets to total customer deposits of bank i in time t; Loan $growth_{i,t}$ is the ratio of yearly change in loans of bank i in time t. Where the variable $Size_{i,t}$ is the natural logarithm of total assets of bank i in time t and bank $risk_{i,t}$ is the ratio of loan loss reserves to gross loans of bank i in time t. $Efficiency_{i,t}$ is the ratio of non-interest expenses to total total assets of bank i in time t. Economic $growth_{i,t}$ is the annual growth in gross domestic product of the country in time t. Our partial model of adjustment for capital ratios also includes factors of unobserved heterogeneity called time V_t and panel-fixed effects u_i. The panel-fixed effects unobserved heterogeneity may be due to the efficiency of management, risk behavior, economic conditions, financial and business liberalization, and governance of banks. (Abbas et al., 2021; Bakkar et al., 2019) supported the inclusion of fixed effects in the capital adjustment model. From Equations (1) and (2) we get the following Equation (3):

$$\text{Capital ratio}_{i,t}=\gamma(\alpha_0+\beta_1 \text{ Capital ratio}_{i,t-1} + \beta_2 \text{ Profitability}_{i,t} +\beta_3 \text{ Liquidity}_{i,t} + \beta_4 \text{ Loan growth }_{i,t} +\beta_5 \text{ Size}_{i,t}+ \beta_6 \text{ Bank risk}_{i,t} +\beta_7 \text{ Economic growth}_{i,t})+ \beta_8\text{Inflation}_{i,t}+\beta_8\text{Efficiency}_{i,t} + Vt+ u_i)+ (1-\gamma) \text{ Capital ratio}_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

The presence of lagged value of the dependent variable in Equation (3) produces biased estimators in OLS-fixed effects framework. To control for the biasedness, we use GMM approach on Equation (3) as suggested by the existing literature (Abbas et al., 2021; Bakkar et al., 2019).

4. RESULTS AND DISCUSSION

4.1 Descriptive and Correlations Statistics

The empirical analysis of this study starts with the descriptive summary of the dependent, independent and control variables. Table 1 reports that averages of capital ratio, regulatory ratio and tier-I ratio are 13.45%, 15.36% and 12.90%, respectively. The profitability has a mean value of 14.56% with a standard deviation of 31.78%. The values of average and standard deviation of loan growth are 22.90% and 46.29%, respectively. The liquidity, bank risk, and efficiency average values are 20.05%, 2.26%, and 44.71%, respectively. Table 2 shows pair-wise correlations between the variables of this study. Most of the correlation coefficients are less than 5% showing that no higher correlations between the variables. It is also suggesting that there is no issue of higher multicollinearity in modeling the variables of the study. The descriptive and correlation results are in line with (Abbas et al., 2021).

This table reports summary statistics for capital ratio measures and other selected variables over the period from 2002 to 2019. Mean, and standard deviation refer to the cross-sectional average and standard deviation of the firms' time-series averages.

4.2 Does the Speed of Adjustment Vary Across Capital, Regulatory, and Tier-I Ratios?

Table 3 shows the empirical results of our full sample analysis of China's commercial banks. Column 1 of Table 3 reports the full sample capital adjustment results for the capital ratio. Column 2 consists of results for regulatory ratio and Tier-I capital ratio results posted in Column 3 of Table 3. From Columns 1 and 2 of Table 3, it is clear that China's banks adjust their regulatory ratio faster than the capital ratio, and thus supports our statement in H_{01}. The full sample results indicate that the average speeds of adjustment (1- γ) for the capital ratios, regulatory ratios and Tier-I ratios are 26.6%, 47.2%, and 34.4%, respectively. Another informative metric, which provides economic meaning to the estimated parameters is the half-life. The half-life is defined as the amount of time required by banks to adjust half of the difference between their actual and target capital ratios. Our speeds of adjustments of capital ratios, regulatory ratios and Tier-I ratios correspond to the half-lives of 2.24, 1.08, and 1.64 years, respectively, which are consistent with (Abbas & Masood, 2020a, 2020b; Bakkar et al., 2019).

Table 1.
Descriptive statistics

Variable	Measurement	Mean	Std. Dev.	Min	Max
Capital ratio	Total equity/Total Asset's ratio	13.45	20.95	3.71	49.76
Regulatory ratio	Tier-I + II/Total risk-weighted assets ratio	15.36	30.40	5.88	34.60
Tier-I ratio	Tier-I/Total Risk-weighted assets' ratio	12.90	30.07	5.03	24.46
Profitability	Net income/Total assets ratio	14.56	31.78	1.42	26.10
Loan growth	Current less previous loan/previous loans	22.67	46.29	-30.5	64.31
Liquidity	Liquid assets/Total customer deposits ratio	20.05	60.07	12.6	51.26
Bank risk	Lona loss reserves/Gross loans	2.62	3.269	-0.08	40.76
Size	Natural logarithm of total assets	10.61	2.4	1.60	19.59
Efficiency	Non-interest expenses/total assets ratio	44.71	36.29	14.08	70.93
Economic growth	Annual growth in gross domestic product	8.51	2.48	4.86	14.23
Inflation	Annual Consumer price index	2.66	1.64	-0.72	5.92

Table 2.
Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Capital ratio	1.000										
Regulatory ratio	0.044*	1.000									
Tier-I ratio	0.057*	0.087*	1.000								
Profitability	0.085*	0.065*	0.022	1.000							
Loan growth	-0.096*	-0.024	0.018	-0.040	1.000						
Liquidity	0.012*	-0.014	0.002	0.089*	-0.011	1.000					
Bank risk	0.015*	-0.029*	-0.023*	0.084*	-0.027*	0.040	1.000				
Size	-0.069*	-0.067*	-0.053*	-0.023*	0.043	-0.033	-0.011*	1.000			
Efficiency	-0.003	0.070*	0.011*	-0.093*	-0.091*	-0.065*	-0.009*	-0.007*	1.000		
Economic growth	-0.038	-0.074*	-0.066*	-0.075*	-0.013	0.017	-0.073*	-0.030*	0.088*	1.000	
Inflation	-0.011	-0.023	-0.021	-0.051*	0.009	0.016	-0.028	-0.067*	0.056*	0.024*	1.000

This table reports the pair-wise correlations for capital ratio measures and other selected variables over the period from 2006 to 2020. * represents the significance at 5%.

4.3 Does the Speed of Capital Adjustment Vary Across Well and Under-Capitalized Banks?

Table 4 exhibits the results of our analysis of capital adjustments for different levels of capital adequacy. Columns 1-3 of Table 4 display the findings for well-capitalized banks; Columns 4-6 report the results for under-capitalized banks. As clear from Table 4, the paces of adjustment of capital ratios (1- γ) of well-capitalized and under-capitalized banks are 32.7% and 12.2%. The speeds of adjustment of regulatory ratios of well-capitalized and under-capitalized banks are 53% and 28.4%, respectively. Table 4, the speed of adjustment of tier-I ratio (1- γ) of well-capitalized and under-capitalized banks are 31.2% and 22.1%, respectively. While comparing both the capital and regulatory ratios, we find

Table 3.
Speed of adjustment across regulatory and non-regulatory capital ratios

Full Sample Results			
VARIABLES	**(1)**	**(2)**	**(3)**
	Capital ratio	**Regulatory ratio**	**Tier-I ratio**
Lag dep. Variable	0.734***	0.528***	0.656***
	(0.097)	(0.012)	(0.026)
Profitability	0.010***	0.109***	-0.005
	(0.004)	(0.010)	(0.027)
Loan growth	-0.030***	-0.133***	-0.123***
	(0.004)	(0.008)	(0.008)
Liquidity	0.009**	0.019***	-0.000
	(0.004)	(0.006)	(0.007)
Bank risk	0.308*	-0.063	-0.409*
	(0.185)	(0.215)	(0.231)
Size	-0.664*	-1.147***	0.407
	(0.342)	(0.382)	(0.553)
Efficiency	0.029*	0.290***	0.029
	(0.015)	(0.046)	(0.069)
Economic growth	0.007	0.036	0.160
	(0.082)	(0.103)	(0.113)
Inflation	0.002	0.084	0.221***
	(0.052)	(0.054)	(0.062)
Constant	6.894*	-0.367	0.171
	(4.028)	(5.761)	(5.893)
Observations	1,457	1,316	1,274
AR (2)	0.567	0.334	0.306
Hansen value	0.859	0.274	0.510

This table used two-step system GMM method to measure the speed of adjustment by using three capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are presented in Column 1; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are disclosed in Column 2, and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are reported in Column 3. Robust standard errors are reported in parentheses. ***, **,* represent statistical significance at 1%,5% and 10% respectively.

that speed of adjustment (1- γ) of well-capitalized banks is higher than under-capitalized banks for all capital ratios. These findings support our H_{02} and show that under-capitalized banks require higher time to restore their target capital ratios than well-capitalized banks. In addition, the time needed to adjust the capital ratio is consistent with (Abbas et al., 2021; Abbas & Masood, 2020b; Bakkar et al., 2019). The findings have important economic meanings in the sense that ceteris paribus well-capitalized banks have easy access to the capital market than under-capitalized banks. Due to this theoretical reason, the speed of adjustment is justified in terms of bank categories.

4.4 Does the Speed of Capital Adjustment Vary Across High and Low Liquid Banks?

Table 5 consists of the outcomes of our analysis of capital adjustments for capital ratio, regulatory ratio and the tier-I ratio of high and low liquid banks. Columns 1-3 of Table 4 display the findings

Table 4.
Capital ratio Adjustment across well and under-capitalized banks

VARIABLES	Well-capitalized banks			Under-capitalized banks		
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital ratio	Regulatory ratio	Tier-I ratio	Capital ratio	Regulatory ratio	Tier-I ratio
Lag. dep. variable	0.673***	0.470***	0.688***	0.878***	0.716***	0.779***
	(0.102)	(0.012)	(0.051)	(0.176)	(0.172)	(0.113)
Profitability	0.012***	0.143***	-0.047	0.001	-0.001	-0.001
	(0.004)	(0.016)	(0.055)	(0.004)	(0.023)	(0.029)
Loan growth	-0.029***	-0.136***	-0.135***	-0.007	-0.029*	-0.036
	(0.004)	(0.008)	(0.008)	(0.007)	(0.016)	(0.033)
Liquidity	0.009**	0.024***	-0.006	0.003	0.023	0.028
	(0.004)	(0.005)	(0.010)	(0.007)	(0.027)	(0.046)
Bank risk	0.539***	0.267	-1.791**	-0.371	0.834*	0.953
	(0.088)	(0.574)	(0.816)	(0.262)	(0.490)	(0.730)
Size	-0.848**	-2.402***	1.524	-0.118	-0.754	-0.973
	(0.421)	(0.510)	(1.194)	(0.226)	(0.458)	(0.749)
Efficiency	0.039**	0.378***	-0.035	-0.005	0.021	0.040
	(0.016)	(0.052)	(0.120)	(0.013)	(0.054)	(0.110)
Economic growth	0.141	0.128	0.100	0.009	0.189	0.194
	(0.110)	(0.173)	(0.172)	(0.057)	(0.637)	(0.508)
Inflation	-0.068	-0.014	0.545***	0.112**	0.232**	0.204
	(0.083)	(0.076)	(0.178)	(0.046)	(0.098)	(0.201)
Constant	7.773	6.568	-2.172	2.317	4.191	4.732
	(5.134)	(8.228)	(8.347)	(2.489)	(4.218)	(6.932)
Observations	1,124	983	961	160	160	144
AR (2)	0.678	0.323	0.313	0.177	0.642	0.906
Hansen value	0.791	0.334	0.115	0.640	0.155	0.226

This table used two-step system GMM method to measure the speeds of adjustment for well-capitalized, and under-capitalized banks by using three alternative capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are reported in Columns 1,4; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are documented in Columns 2,5; and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are disclosed in Columns 3, and 6. Columns 1-3 report the results for well-capitalized banks; Columns 4-6 report the results for under-capitalized banks. A well-capitalized bank has an overall risk-based capital ratio (Tier I + II/Total Risk-weighted assets ratio) of 10 percent or more; and a ratio less than or equal to 8 percent is considered under-capitalized. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at 1%,5% and 10% respectively.

for high liquid banks, Columns 4-6 report the results for low liquid banks. As clear from Table 5, the paces of adjustments of capital ratios (1- γ) of highly liquid and low liquid banks are 35.2% and 20.8%, respectively. The speeds of adjustment of regulatory ratios of highly liquid and low liquid banks are 48.2% and 25.3%, respectively. Table 4, the speed of adjustment of tier-I ratio (1- γ) of highly liquid and low liquid banks are 47.2% and 30.7%, respectively. While comparing both the capital and regulatory ratios, we find that speed of adjustment (1- γ) of high liquid banks is higher than liquid banks for all capital ratios. These findings support our H_{02} and show that low liquid banks require higher time to restore their target capital ratios than high liquid banks. And, the time needed to adjust the capital ratio is consistent with (Abbas et al., 2021; Bakkar et al., 2019). The findings

have important economic meanings because ceteris paribus high liquid banks can easily attract investors' than low liquid banks. Due to this theoretical reason, the speed of adjustment is justified in terms of bank categories.

4.5 Does the Speed of Capital Adjustment Vary Across High and Low Growth Banks?

Table 6 consists of the outcomes of our analysis of capital adjustments for capital ratio, regulatory ratio and the tier-I ratio of high and low growth banks. Columns 1-3 of Table 4 display the findings for high growth banks, Columns 4-6 report the results for low growth banks. As clear from Table 6,

Table 5.
Adjustment of capital ratios for high and low liquid banks

VARIABLES	High liquid banks			Low liquid banks		
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital ratio	Regulatory ratio	Tier-I ratio	Capital ratio	Regulatory ratio	Tier-I ratio
Lag. dep. Variables	0.648***	0.518***	0.528***	0.792***	0.747***	0.693***
	(0.147)	(0.007)	(0.007)	(0.112)	(0.012)	(0.011)
Profitability	0.011***	0.265***	0.261***	0.009**	0.046***	0.059***
	(0.004)	(0.010)	(0.012)	(0.004)	(0.009)	(0.009)
Loan growth	-0.029***	-0.162***	-0.165***	-0.037***	-0.083**	-0.101***
	(0.004)	(0.006)	(0.006)	(0.010)	(0.036)	(0.036)
Liquidity	0.007**	0.078***	0.084***	0.006	0.005	0.008**
	(0.003)	(0.012)	(0.017)	(0.004)	(0.004)	(0.003)
Banks risk	0.509***	4.923***	4.743***	0.184	-0.605	-0.567
	(0.095)	(0.370)	(0.544)	(0.176)	(0.399)	(0.404)
Size	-1.490**	-4.210***	-4.851***	-0.480	-0.056	-0.133
	(0.713)	(0.892)	(1.098)	(0.292)	(0.208)	(0.223)
Efficiency	0.027	0.616***	0.615***	0.023	0.084***	0.125***
	(0.017)	(0.055)	(0.057)	(0.016)	(0.024)	(0.024)
Economic growth	0.145	-0.513	-0.651	-0.021	0.088	0.069
	(0.192)	(0.589)	(0.642)	(0.075)	(0.095)	(0.099)
Inflation	-0.100	-0.305	-0.294	0.029	0.067	0.086
	(0.255)	(0.420)	(0.425)	(0.065)	(0.079)	(0.079)
Constant	16.818*	0.154	7.175	5.405	-1.761	-3.463
	(9.042)	(15.030)	(16.557)	(3.484)	(3.218)	(3.254)
Observations	331	226	222	1,291	1,175	1,140
AR (2)	0.343	0.230	0.227	0.633	0.306	0.299
Hansen value	0.727	0.110	0.316	0.385	0.313	0.544

This table used two-step system GMM method to measure the speeds of adjustment for high and low liquid banks by using three alternative capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are reported in Columns 1 and 4; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are posted in Columns 2 and 5; and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are documented in Columns 3 and 6. Based on annual cross-sectional median liquidity value, above median are highly liquid banks, and low liquid banks otherwise. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at 1%,5% and 10% respectively.

the paces of adjustments of capital ratios (1- γ) of high and low growth banks are 38.7% and 17.5%, respectively. The speeds of adjustment of regulatory ratios of high and low growth banks are 49.9% and 41.5%, respectively. Table 6, the speed of adjustment of tier-I ratio (1- γ) of high and low growth banks are 51.2% and 43.7%, respectively. While comparing both the capital and regulatory ratios, we find that speed of adjustment (1- γ) of high-growth banks is higher than liquid growth banks for all capital ratios. These findings support our H_{02} and show that low growth banks require higher time to restore their target capital ratios than high growth banks. And, the time required to adjust the capital ratio is consistent with (Abbas & Masood, 2020b; Bakkar et al., 2019). The findings have important economic meanings because ceteris paribus high growth banks can easily attract capital market investors than low growth banks. Due to this theoretical reason, the speed of adjustment is justified in terms of bank categories.

Table 6.
Adjustment of capital ratios for high and low growth banks

VARIABLES	High growth banks			Low growth banks		
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital ratio	Regulatory ratio	Tier-I ratio	Capital ratio	Regulatory ratio	Tier-I ratio
Lag. dep. Variable	0.613***	0.501***	0.488***	0.825***	0.585***	0.563***
	(0.147)	(0.010)	(0.008)	(0.086)	(0.029)	(0.029)
Profitability	0.018***	0.086***	0.101***	0.008*	0.136***	0.144***
	(0.003)	(0.017)	(0.018)	(0.004)	(0.013)	(0.012)
Lona growth	-0.028***	-0.095***	-0.097***	-0.032***	-0.323***	-0.322***
	(0.008)	(0.015)	(0.015)	(0.009)	(0.045)	(0.046)
Liquidity	0.006	0.004	0.010	0.007*	0.014*	0.018**
	(0.006)	(0.010)	(0.009)	(0.004)	(0.007)	(0.007)
Banks risk	0.178	-1.132	-1.159	0.146	1.697***	1.619***
	(0.698)	(0.904)	(0.901)	(0.165)	(0.445)	(0.420)
Size	-0.325	-0.365	-0.649	-0.532**	-0.847***	-0.949***
	(0.551)	(0.552)	(0.619)	(0.266)	(0.262)	(0.268)
Efficiency	0.073***	0.181*	0.235**	0.016	0.260***	0.288***
	(0.025)	(0.097)	(0.096)	(0.018)	(0.049)	(0.046)
Economic growth	-0.152	0.076	0.026	0.098	0.164	0.104
	(0.136)	(0.203)	(0.215)	(0.095)	(0.168)	(0.174)
Inflation	0.122**	0.039	0.065	-0.120	0.273**	0.262**
	(0.053)	(0.079)	(0.079)	(0.103)	(0.129)	(0.131)
Constant	2.680	-0.952	-1.901	5.599*	-9.854**	-10.741**
	(6.792)	(8.903)	(9.713)	(3.000)	(4.669)	(4.676)
Observations	636	588	562	821	728	712
AR (2)	0.714	0.324	0.322	0.428	0.247	0.256
Hansen value	0.374	0.380	0.356	0.813	0.331	0.333

This table used two-step system GMM method to measure the speeds of adjustment for high and low growth banks by using three alternative capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are reported in Columns 1 and 4; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are posted in Columns 2 and 5; and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are documented in Columns 3 and 6. Based on annual cross-sectional median loan growth value, above median are highly growth banks, and low liquid banks otherwise. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at 1%,5% and 10% respectively.

4.6 Does the Speed of Capital, Regulatory, and Tier-I Ratio Adjustment Vary in GFC-2008?

Our study also provides evidence for the speeds of capital adjustment in the GFC-2008 period in the Chinese' banks. Table 7 contains the empirical findings for capital ratio, regulatory ratio, and the tier-I ratio of the Chinses commercial banks for GFC-2008 in Columns 1, 2 and 3, respectively. Table 7, the paces of adjustments of capital ratio, regulatory ratio and tier-I ratio (1- γ) of Chinses commercial banks during GFC-2008 are 6.1%, 47.7% and 47.8%, respectively. The results show that the speed of adjustment for the capital ratio is lower than regulatory ratios in GFC-2008. The higher speed of adjusting regulatory capital ratios indicates the significance of regulations and stringent monitoring during turmoil sessions, which is in line with (Abbas et al., 2021).

Table 7.
Capital ratio adjustment during GFC-2008

VARIABLES	(1)	(2)	(3)
	Capital ratio	Regulatory ratio	Tier-I ratio
Lag. dep. Variable	0.939***	0.523***	0.522***
	(0.125)	(0.007)	(0.007)
Profitability	0.018**	0.009	0.015
	(0.007)	(0.012)	(0.013)
Loans growth	-0.035***	-0.016	-0.018
	(0.013)	(0.025)	(0.024)
Liquidity	0.005	0.010	0.015
	(0.010)	(0.009)	(0.009)
Bank risk	0.285*	3.473***	3.523***
	(0.146)	(0.190)	(0.200)
Size	-0.204	-0.709	-0.978
	(0.402)	(0.584)	(0.627)
Efficiency	0.032**	0.084***	0.099***
	(0.015)	(0.028)	(0.029)
Economic growth	0.178	-0.067	-0.070
	(0.120)	(0.110)	(0.113)
Inflation	0.100*	0.073	0.086
	(0.057)	(0.076)	(0.074)
Constant	-2.307	2.012	2.589
	(5.936)	(7.024)	(7.646)
Observations	312	282	273
AR (2)	0.225	0.308	0.314
Hansen value	0.293	0.515	0.410

This table used two-step system GMM method to measure the speeds of adjustment during GFC-2008 by using three alternative capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are reported in Columns 1; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are posted in Columns 2; and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are documented in Columns 3. The GFC period is 2007 to 2009. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at 1%,5% and 10% respectively.

4.7 Robustness Checks

The study conducts several checks concerning baseline model results. For example, the difference in difference method is applied on Equation (3), and the findings remain consistent with baseline estimations. In Table 8, we report the results for the speed of adjustment of capital ratio, regulatory ratio and tier-I ratio for overall sample banks only. Our findings in Table 8 show that the speeds of adjustment of capital ratio, regulatory ratio and tier-I ratio are 34.6%, 43.7%, and 43.5%, respectively. These findings suggest that banks adjust their capital ratio slower than the regulatory and tier-I ratio.

5. CONCLUSION AND IMPLICATIONS

New research has looked into the effect of bank capital ratios on risk-taking and financial performance after the GFC-2008. However, the motives behind the regulation of capital ratios and the speed at

Table 8.
Speed of adjustment across regulatory and non-regulatory capital ratios

VARIABLES	(1)	(2)	(3)
	Capital ratio	Regulatory ratio	Tier-I ratio
Capital ratio $_{t-1}$	0.654***	0.563***	0.565***
	(0.018)	(0.013)	(0.013)
Profitability $_{t-1}$	0.005***	0.088***	0.094***
	(0.001)	(0.009)	(0.009)
Loan growth $_{t-1}$	-0.028***	-0.188***	-0.187***
	(0.003)	(0.010)	(0.011)
Liquidity $_{t-1}$	0.003**	0.011	0.013
	(0.002)	(0.012)	(0.012)
Bank risk $_{t-1}$	0.030	-0.031	0.065
	(0.055)	(0.316)	(0.322)
Size $_{t-1}$	-0.505***	-1.957***	-2.293***
	(0.169)	(0.601)	(0.625)
Efficiency $_{t-1}$	0.019***	0.149***	0.168***
	(0.005)	(0.028)	(0.029)
Economic growth $_{t-1}$	-0.071	-0.025	-0.049
	(0.063)	(0.226)	(0.232)
Inflation $_{t-1}$	-0.038	0.006	0.012
	(0.062)	(0.222)	(0.229)
Constant	9.186***	17.887**	19.318**
	(2.219)	(8.193)	(8.456)
Observations	1,457	1,316	1,274
R-squared	0.672	0.682	0.691

This table used difference in difference method to measure the speed of adjustment by using three capital ratios. Capital ratio (Total Equity/Total Asset's ratio) results are presented in Column 1; regulatory ratio (Tier I + II/Total Risk-weighted assets ratio) results are disclosed in Column 2, and Tier-I ratio (Tier I/Total Risk-weighted Assets' ratio) results are reported in Column 3. Robust standard errors are reported in parentheses. ***, **,* represent statistical significance at 1%,5% and 10% respectively.

which this regulation is enforced are currently unknown. Our work is aimed at bridging this gap in the literature. The study employs the GMM approach on data from China commercial banks from 2006 to 2020 to demonstrate that banks adjust their regulatory ratio and tier-I ratio faster than capital ratio; and in most cases, the speed of adjustment of a capital ratio is slower than that of a regulatory ratio and tier-I ratio.

Our results show that the pace of regulatory capital ratio of well-capitalized banks is faster than under-capitalized banks. Our analysis report that high-liquid banks adjust their capital ratios faster than low-liquid banks. We also find that the speed of adjustment of the regulatory ratio and tier-I ratio of high-growth commercial banks is faster than low-growth banks. In addition, the speed of adjustment of regulatory capital ratios of commercial banks is higher than capital ratio during the GFC-2008 era.

Our findings have important implications for regulators. For instance, the heterogeneity in the speed of capital adjustment across well-capitalized, under-capitalized, high and low liquid, high and low growth banks and during economic conditions (GFC-2008) suggest that the regulators may consider this heterogeneity across different bank characteristics for the formulation of new regulations about the adjustment of bank capital ratios. These findings may be especially valuable for supervisors when reviewing and revising specific capital requirements under Pillar II of the Basel III agreement.

Our study's findings are confined to a review of large commercial banks of China. We are still unable to collect data from smaller commercial banks, savings banks, cooperative banks, and investment banks over a longer period. To gain more in-depth insights, future studies should focus on the speed with which banks modify their capital ratios while taking into account the mediating/moderating effect of other economic variables and bank regulations.

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