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Quantitative modeling of the relationship between Basel III Capital Buffers and key strategic solutions: A case study of commercial banks in Vietnam

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Abstract: The Basel III Capital Buffers were introduced by the Basel Committee on Banking Supervision after the 2008 global financial crisis to strengthen global bank stability by providing additional capital layers that can absorb potential losses and manage excessive credit growth. In Vietnam, the implementation of these buffers has presented considerable challenges, especially for commercial banks, where tailored solutions must be customized to align with the unique scale, structure, and characteristics of each institution. This article examines the impact of various strategic approaches on implementing Basel III Capital Buffers in Vietnamese commercial banks. The regression research model employs a 5-level Likert scale, using a questionnaire of 6 variables representing 40 distinct indicators, in a survey conducted across 115 banking institutions in Vietnam. The findings reveal that strategies for capital increases through securities issuance, reinvestment from business activities, and system upgrades significantly influence buffer implementation. Securities-related capital increases have the most significant effect, followed by system upgrades and business reinvestment. In contrast, delays in state capital injections and persistent operational challenges hinder progress. The study offers practical recommendations to enhance Basel III compliance in Vietnam by optimizing capital management strategies and addressing key implementation barriers to ensure the long-term resilience of the banking sector.

Keywords: *Basel III capital buffer, Basel III Implementation, Capital conservation buffer, Vietnam.*

1. Introduction

Capital buffers are a fundamental aspect of the Basel III reforms introduced by the Basel Committee on Banking Supervision (BCBS) in response to the 2008 global financial crisis. The Capital Conservation Buffer (CCoB) provides banks with an additional capital cushion to absorb potential losses during periods of economic distress. The Countercyclical Capital Buffer (CCyB) supports macroprudential goals by helping banks manage systemic risks arising from excessive credit growth in the financial system. Moreover, the buffers for Global Systemically Important Banks (GSIBs) and Domestic Systemically Important Banks (DSIBs) impose higher total loss-absorbing capacity requirements, mitigating risks at both global and domestic levels.

To implement these capital buffers, banks worldwide have adopted tailored solutions suited to their specific characteristics and scale, in alignment with technical guidelines from the Bank for International Settlements (BIS), legal regulations, and the infrastructural capabilities of their respective banking systems. In Vietnam, banks have also implemented Basel III Capital Buffers to enhance their resilience against financial shocks and crises. However, the complexity of the calculation methods, constrained resources, and divergent policy frameworks have resulted in the implementation falling short of expectations. Although research on Basel III capital regulations exists, the diverse contexts, characteristics, and operational approaches of different banks necessitate distinct solutions. Tailored

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strategies are crucial not only for improving banks' resilience in times of crisis but also for boosting their competitiveness by ensuring timely compliance with Basel III capital buffer requirements. Accordingly, Section 2 of this article will provide a literature review, focusing on previous studies related to the implementation of Basel III Capital Buffers and strategic solutions. Section 3 will outline the research methods, including the dataset and the methodology employed in the study. Section 4 will present the research results and offer comments on the findings, while Section 5 will conclude with key recommendations based on the analysis.

2. Literature Review

Basel III capital buffers issued by BCBS are applied by banks as an international practice in the banking and finance sector. The level and ability to implement these buffers depend on the financial capacity, capital, asset quality of banks and regulations of the authority. The definition of capital is necessary for banks to have a basis for establishing buffers to cover potential losses; it is a prerequisite for countries to comply to stabilize their financial systems [1-3].

Basel III capital buffers include:(i) Capital conservation buffer (CCoB) is designed to ensure that banks have an additional layer of available capital that can be drawn upon in the event of losses. CCoB is set at 2.5% of total risk-weighted assets, which is established above the regulatory minimum capital requirement and must be met with Common Equity Tier 1 (CET1) capital. Whenever the buffer falls below 2.5%, automatic constraints on capital distribution (for example, dividends, share buybacks and discretionary bonus payments) will be imposed to replenish the buffer until it reaches the minimum requirement [2, 3] (ii) Countercyclical capital buffer (CCyB) varies between 0 and 2.5% of total risk-weighted assets and must be met with CET1 capital, which is based on the authorities' assessment when excessive aggregate credit growth could accumulate system-wide risks. This buffer is drawn down during recessions to help banks maintain credit flow in the economy. CCyB is implemented as an extension of the capital conservation buffer. Accordingly, banks that do not meet CCyB requirements will be restricted from automatic distribution through minimum capital conservation ratios that a bank must meet at different levels of the CET1 capital ratio [2, 3] (iii) Global systemically important bank (GSIB) surcharge requires higher loss absorbency of 1% to 3.5% of total risk-weighted assets and must be met with CET1 capital, based on 5 buckets of systemic importance scores [4] the number of buckets could increase in the future to maintain incentives for banks to avoid becoming more systemically important (bucket 6 could be created with a minimum higher loss absorbency (HLA) requirement of 4.5%); (iv) Domestic systemically important bank (DSIB) surcharge is a complementary perspective to the GSIB surcharge mechanism which focuses on the impact of banks' distress or bankruptcy on the domestic economy. Principles developed by the DSIB Committee will allow countries to have appropriate discretion in calibrating higher loss absorbency requirements for DSIBs (using qualitative and quantitative methods where available), which are compatible with GSIB framework and must meet with CET1 [5]. National authorities should implement higher loss absorbency requirements through expanding the conservative capital buffer, maintaining the division of the buffer into four equally sized quartiles (BCBS RBC 30.17).

The capital buffer must be met by common equity tier 1 - CET1 [2, 3]. Cohen [6] in his study "How have banks adjusted to higher capital requirements" pointed out that a bank who wants to increase its risk-adjusted capital ratio will have a number of strategies at its disposal: (i) The first group of strategies targets the bank's retained earnings: the bank may seek to reduce the portion of profits they pay out as dividends; attempt to increase their own profits by increasing the spread between the interest rate they charge on loans and the interest rate they pay on their own funding; other ways to increase net income include increasing the profit margin on other lines of business (such as custody or advisory services and reducing general operating expenses); (ii) The second group of strategies involves issuing new shares, either through right issue to existing shareholders, market offering, or the sale of a portion of shares to outside investors; (iii) The third group of strategies involves changes to the asset side of the bank's balance sheet. The bank may reduce its loan portfolio or sell assets outright and use

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the proceeds from the debt repayment or asset sale to repay debt. In some cases, asset sales may generate capital gains through accounting gains because assets are revalued relative to their purchase price; (iv) The bank may seek to reduce its risk assets by replacing riskier (higher weighted) assets with safer loans or government securities. Gropp, et al. [7] in their study "Bank Response to Higher Capital Requirements: Envidence from a Quasi – Natural Experiment" found that banks can increase their regulatory capital ratios in two different ways: Increasing regulatory capital (the numerator of the capital ratio) or shrinking risk-weighted assets (the denominator of the capital ratio) [8]. While raising capital is considered good deleveraging by regulators, shrinking assets can have negative impacts if many banks simultaneously engage in a lending cut [9]. Banks adjust their balance sheets (both asset and liability sides) to meet higher capital requirements [10, 11].

Regarding state capital, Thanh [12] in the study "Proposed solutions to increase capital in state-owned commercial banks" proposed a number of empirical solutions at banks to address the decline in capital adequacy ratio below the regulated level. The study stated that main causes of the decline in capital adequacy ratio (CAR) are: the bank's profitability is declining, the rate of increase in equity capital is slow and risky assets are increasing. Difficulties in increasing capital at commercial banks include: (i) Increasing capital from the solution of reducing dividend payments is the most favorable solution for banks; but also facing difficulties because authorities require all dividends of state shareholders to be transferred to the state budget; (ii) Increasing capital from issuing additional shares to existing investors, attracting more investors and selecting foreign strategic investors. The effectiveness of this solution depends on the level of interest of investors and market conditions; (iii) Increasing capital from saving management costs and expanding non-interest income only meets with a small portion of capital increase demand; (iv) Increasing capital from supplementing the state budget is a suitable solution for state-owned commercial banks; but the effectiveness depends on the size of the budget and the approval of authorities according to the macroeconomic situation; (v) Increasing capital from increasing profitability and adjusting the balance sheet to reduce risky assets. Accordingly, Thanh [12] proposed a number of solutions related to state policies and state-owned commercial banks (allowing the use of annual dividends to increase capital for the following year; using surplus resources due to the reduction of the State's ownership ratio from the sale of financial investments, strategic sales to make advance payments of dividends in shares to increase capital; saving management costs; continuing equitization, reducing the State's ownership ratio; selling shares to foreign strategic investors; making advance payments of enterprise support funds to increase capital; and in the long term, it is possible to issue bank bonds, speeding up the equitization process...). Tung [13] in the study "Some recommendations on increasing equity capital at commercial banks" stated that: "To achieve the goal of increasing capital, commercial banks should focus on three main solutions: Issuing shares to pay dividends; issuing privately; increasing charter capital from the state budget". Also on this topic, Nguyễn [14] in "Research on Basel III implementation at Vietnam's commercial banks" pointed out groups of solutions to increase capital such as increasing securities capital, increasing state capital, increasing capital from banking business activities.

According to Basel Committee on Banking Supervision (BIS) [2] and Basel Committee on Banking Supervision (BIS) [3] Basel III Capital Buffers (CCoB, CCyB, GSIB, DSIB) to ensure banks' macroprudential status should be implemented under: (i) A legal framework to support banks in implementing capital regulations, buffers and other regulations of Basel III; (ii) the important role of banking supervisors in supervising safety, requiring inspection of banks implementing the Internal Capital Adequacy Assessment Process (ICAAP), the internal liquidity adequacy assessment process (ILAAP); (iii) regulations on important bank ratings GSIB, DSIB; (iv) orientation for developing independent credit rating organizations, auditors, providing Basel III technology services. Also on this topic, Nguyễn [14] in "Research on Basel III implementation at Vietnam's commercial banks" surveyed and assessed the current status of Basel II/III implementation at 115 credit institutions operating in Vietnam; pointed out groups of solutions to implement Basel III including: Group of solutions to increase capital, strategic solutions, technology solutions, human resources solutions, banking system

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solutions (orientation of authorities; role of banking supervision agencies; development of credit rating networks and the role of third parties in providing banking technology services...); and a group of solutions related to the regression model of the relationship between the level of Basel III implementation and some key solutions.

On the difficulties and challenges in implementing Basel III, when conducting research in developing countries, Ferreira, et al. [1] argued that the persistent weakness of developing countries comes from the ability to monitor the system. Accordingly, the weakness mainly comes from following reasons: Inappropriate institutional setup; Lack of human resources with suitable knowledge and experience; Analytical tools do not produce appropriate results to predict future development directions; Loose credit risk standards; Inappropriate liquidity risk standards and monitoring; Inappropriate governance capacity; Weak enforcement capacity. Despite similar comments, Casier and Raskopf [15] when conducting research in METAC member countries, delved deeper into factors that prevent Basel III implementation. Accordingly, top 4 reasons pointed out by Casier and Raskopf [15] include: Supervisory team capacity, infrastructure development and IT implementation capabilities, changing old thinking towards risk control, and lack of necessary human resources. Thus, comparing two studies with different research subjects, it can be seen that the human factor is the most common factor mentioned throughout these two studies. Difficulties and challenges in implementing Basel III are also pointed out by Chabanel [16]; Suarez [17]; Uprety [18] and Vousinas [19] in the studies "Implementing Basel III: challenges, Options & Opportunities ", "Basel III in Chile: Advantages, Disadvantages and challenges from implementing the new bank capital standard", "Basel III Implementation: Challenges and Opportunities in Nepal", "Supervision of financial institutions. The transition from Basel I to Basel III. A critical evaluation of the newly established regulatory framework".

In addition to the human factor, the technological factor to establish a predictive model is also mentioned in these two studies. For developing countries, due to infrastructure factors, along with human resources that do not meet the development requirements of technology, building data processing models, collecting data, and using model results to build scenarios according to Basel III regulations also faces many difficulties [16]. Therefore, it can be concluded that these factors will be main difficulties that developing countries will face when making the transition to applying international accounting standards (IFRS9) and using key technologies related to Basel III (automation technology, cloud computing, Blockchain, Suptech, Regtech).

3. Research Model and Hypothesis

The above literature review shows that Basel III capital buffer regulation must be met by common equity tier 1 – CET1 [2, 3]. Capital increases can be done through: (i) Capital solutions related to securities such as issuance of new shares; retained earnings; dividends distribution limit; issuance of long-term bonds; issuance of convertible bonds [6, 12, 14]; (ii) capital solutions related to state capital such as widening room to sell state shares to foreign investors; using surplus resources due to reducing the state ownership ratio from financial investment sales, strategic sales to advance stock dividend payments to increase capital; promoting equitization process and reducing state ownership in commercial banks; increasing capital from additional state budget sources; non-performing loans (NPLs) resolution [12, 14] (iii) capital solutions related to business activities such as downsizing business and service activities in some ineffective sections; developing new business services; applying new technology to reduce operating costs; using low-cost strategies to save capital; deducting amounts that do not comply with regulations on Tier 1 and Tier 2 capital of Basel III [6, 12-14] (iv) system-wide solutions such as developing and promulgating a legal framework to support banks' implementation; improving banking supervision methods, techniques, and tools in accordance with Basel III; developing credit rating network and bank rating network in accordance with Basel III; improving the capacity of supervisory, licensing and assessment agencies to meet with Basel III standards, GSIB and DSIB systems for banks; developing cultural consultation of BCBS; international

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accounting, information technology systems [14]. Difficulties and challenges in implementing Basel III [1, 14, 15]. Accordingly, the author proposes a research model "Relationship between the level of implementation of Basel III Capital Buffer and some solutions" as shown in Figure 1.

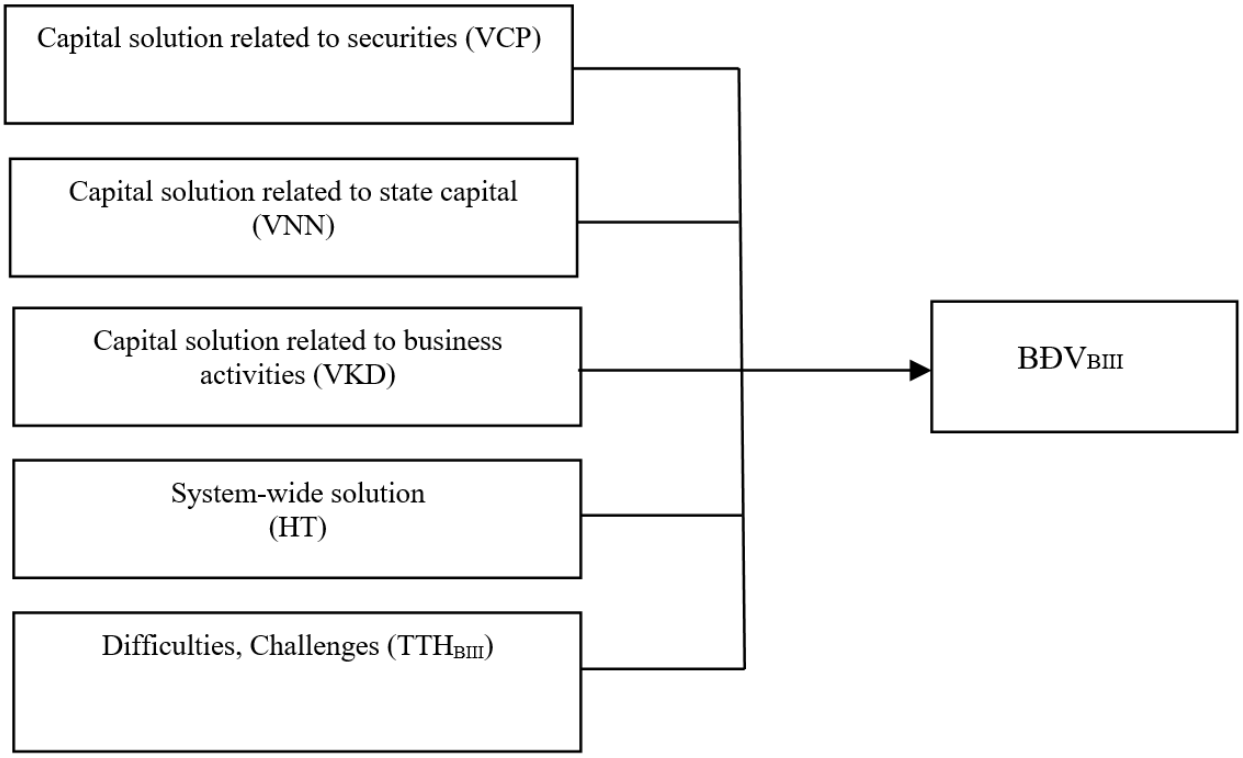

Figure 1.
Model to study the relation between the level of implementation of Basel III capital buffer and a number of solutions.

The research hypotheses are as follows:

H_1, H_2, H_3, H_4: There is a positive relationship between the variables VCP, VNN, VKD, HT and $BĐV_{BIII}$

H_5: There is a negative relationship between the variable TTH_{BIII} and $BĐV_{BIII}$

4. Research Methods

The expected multivariate regression equation is as follows:

$$BĐV_{BIII} = \beta_0 + \beta_1.VCP + \beta_2.VNN + \beta_3.VKD + \beta_4.HT + \beta_5.\ TTH_{BIII} + e_i \quad (1)$$

In which: (i) $BĐV_{BIII}$ is the dependent variable for the level of implementation of Basel III capital buffers at banks (including capital conservation buffer CCoB, countercyclical capital buffer CCyB; global systemically important bank GSIB surcharge; domestic systemically important bank DSIB surcharge; (ii) VCP, VNN, VKD, HT, TTH_{BIII} are independent variables extracted from factor analysis (corresponding to solutions to increase capital related to securities; solutions to increase capital related to the state; solutions to increase capital related to banking business; system-wide solutions; and difficulties and challenges in implementing Basel III at banks); (iii) β_0, β_1, β_2, β_3, β_4, β_5 are partial regression coefficients; (iv) e_i is a random independent variable which follows normal distribution with mean 0 and constant variance σ^2.

The study was conducted using quantitative methods, using SPSS software for statistical analysis and multivariate regression based on a questionnaire survey (December 2023 ~ January 2024) with appropriate sample size. The survey questionnaire uses a Likert scale with 5 indicator levels. Questions

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about the level of implementation of the Basel III capital buffer are extracted by the author from the content of the Basel III accord [2, 3]. Questions about solutions, difficulties and challenges in implementing Basel III are proposed by the author based on research overview, international experience and empirical analysis [1, 6, 12-14]. By editing and amending, the author designed the official survey questionnaire as shown in Table 1.

Table 1.
Survey questionnaire to study the relation between the level of implementation of the Basel III capital buffer with a number of main solutions and implementation challenges.

Variable	Name	Question
Basel III capital buffer of commercial banks ($BĐV_{BIII}$)	CCoB 1	Level of implementation of "Capital Conservation Buffer - CCoB" according to Basel III regulations at your bank
	CCoB 2	The implementation level of "Restriction on automatic capital distribution" according to Basel III regulations when the capital conservation buffer CCoB falls below 2.5% at your bank
	CCyB 1	The implementation level of "Counter-cyclical capital buffer - CCyB" according to Basel III regulations at your bank
	CCyB 2	The level of establishing a "Distribution restriction mechanism" according to Basel III regulations to ensure the CCyB ratio required by authorities at your bank
	GSIB	Level of establishing "GSIB surcharge" according to Basel III regulations at your bank
	DSIB	Level of establishing "DSIB surcharge" according to Basel III regulations at your bank
Difficulties and challenges implementing Basel III at commercial banks (TTH_{BIII})	TTH1	Raising capital to meet Basel III capital standards at your bank faces many difficulties, lacking solutions to increase capital
	TTH2	Your bank encounters difficulties building data management models
	TTH3	Lack of analytical data is a major challenge to implement Basel III at your bank
	TTH4	Your bank encounters many difficulties in using models and building scenarios according to Basel III regulations
	TTH5	Your bank has not yet accessed independent external credit rating agencies to implement risk capital calculation methods according to Basel III regulations.
	TTH6	Challenges in converting to international accounting standards (IFRS9)
	TTH7	Challenges in using key technologies related to Basel III (automation technology, cloud computing, Blockchain, Suptech, Regtech)
Solutions to increase capital related to securities (VCP)	TV1	Issuance of new shares
	TV2	Retained earnings
	TV3	Restriction on dividend distribution
	TV4	Issuance of long-term bonds
	TV5	Issuance of convertible bonds
Solutions to increase capital related to state capital (VNN)	TV6	Open room, sell shares to foreign strategic investors
	TV7	Using surplus resources due to reducing the state ownership ratio from financial investment sales, strategic sales to advance dividend payments to increase capital
	TV8	Promote equitization and reduce the state ownership ratio in state-owned commercial banks SOCBs (commercial banks with high ratio of state ownership)
	TV9	Increase capital from additional state budget sources.
	TV10	Non-performing loan resolution
Solutions to increase capital related to banking business (VKD)	TV11	Downsizing business and service activities in some ineffective sections
	TV12	Deducting amounts that do not comply with regulations on Tier 1 and Tier 2 capital of Basel III
	TV13	Developing new business services
	TV14	Applying technology to reduce operating costs
	TV15	Use low-cost strategies to save capital

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System-wide solutions (HT)	HT1	Identifying Basel III and subsequent versions of Basel III as for the safety of the banking system
	HT2	Authorities orient capital increase for the banking system in the medium and long term
	HT3	Developing and promulgating solutions to support banks in implementing Basel III definitions
	HT4	Improving banking supervision methods, techniques, and tools in accordance with Basel III (Developing banking supervision manuals, skills for supervision, analysis, inspection, warning, early intervention...)
	HT5	Developing a credit rating network that meets with Basel III standards
	HT6	Developing a bank rating network in accordance with Basel III
	HT7	Improving the capacity of supervisory, licensing and assessment authorities to meet with Basel III standards for banks
	HT8	The rating system for global systemically important banks and domestic systemically important banks is consistent with Basel III guidelines.
	HT9	Building a culture of banking inspection and supervision towards risk management regulations according to Basel III international practices
	HT10	Using the advisory support of the Basel Committee
	HT11	Giving guidance to banks to apply international accounting practices (IFRS)
	HT12	Improving the information technology system of the banking supervision agency

Regarding survey size, the author conducted a survey of commercial banks doing business in Vietnam with an appropriate number of survey forms for research requirements (according to Nguyen [20]), normal scale for regression analysis, correlation or group testing is at least 100 or more than 100 observations; according to Hair, et al. [21] there should be about 384 observations). The survey subjects were 115 credit institutions, foreign bank branches, 100% foreign-owned banks, and financial companies with banking operations in Vietnam. Commercial bank officials with appropriate positions to answer survey questions are leaders and officers working in risk management, Basel II/III project management, capital accounting, strategic planning, media and a number of other relevant staff.

5. Research Results and Comments

Descriptive statistics of the survey sample: The author sent official dispatches to 115 credit institutions, foreign bank branches and financial companies in Vietnam. The result was 212 valid survey forms. The research focuses on commercial banks, so the author continues to leave out survey forms from groups of financial companies in Vietnam; the remaining results were 191 official forms, which is eligible for inclusion in research analysis. The survey structure by field of work is described in Figure 2. The survey also shows that survey participants have decent ability, qualifications, and experience (51.4% university degree; 48.6% master's degree; 43.9% over 15 years of working experience; 28.8% from 11 ~ 15 years; 21.2% from 6 ~ 10 years; 6.1% less than 5 years). Therefore, the survey sample is basically suitable for quantitative research.

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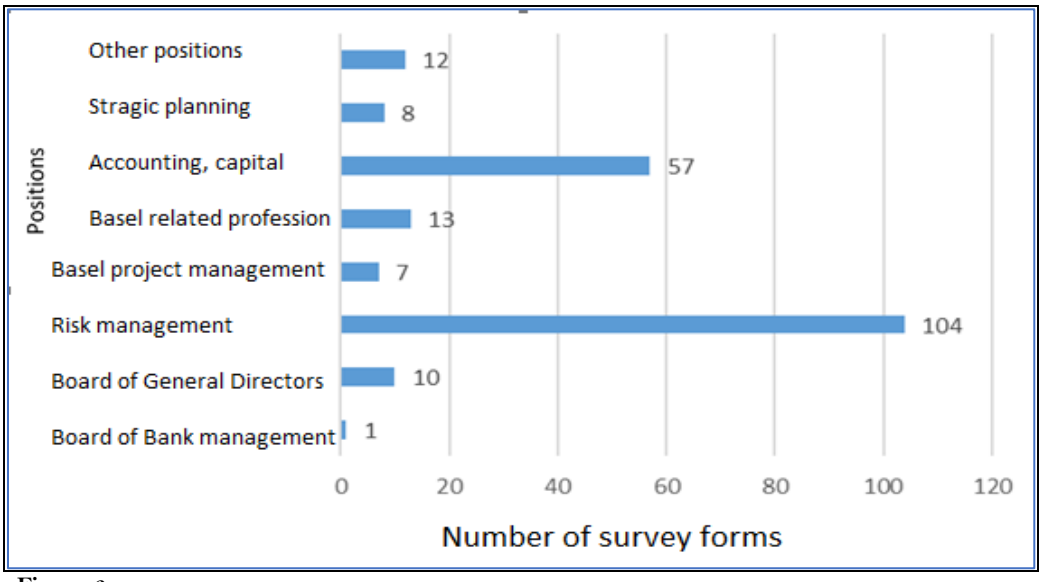

Figure 2.
Structure of survey participants.

Results of scale testing: The author tested the scale through the Cronbach's Alpha coefficient for each group of observed variables of the independent and dependent variables (according to Peterson [22]), Cronbach's Alpha must be 0.6 or higher). Then the author performed an exploratory analysis of the EFA factor to evaluate the reliability, analyze and adjust factors accordingly [23] believes that in factor analysis, factors must reach KMO≥ 0.5; Sig. ≤0.05; total variable correlation ≥ 0.3; factor loading ≥ 0.5). The results of scale analysis and testing are as shown in Table 2:

Table 2.
Assessment of reliability of scale testing and factor analysis.

Varibale	Eliminated variable	Number of factors extracted	Name of new factor	Cronbach's Anpha	Corrected item – Total Correlation	Sig.	KMO	Assessment of reliability
$BĐV_{BIII}$	GSIB	1	$BĐV_{BIII}$ (CCoB1, CCoB2, CCyB1, CCyB2, DSIB)	0.946	0.677~0.925	0.00	0.731	Reliable
TTH_{BIII}		1	TTH_{BIII} (TTH1~TTH7)	0.917	0.540~0.905	0.00	0.904	Reliable
VCP	TV5	1	VCP(TV1~TV4)	0.826	0.609~0.696	0.00	0.658	Reliable
VNN	TV10	1	VNN (TV6 ~TV9)	0.888	0.622~0.886	0.00	0.781	Reliable
VKD		1	VKD (TV11~TV15)	0.896	0.608~0.802	0.00	0.815	Reliable
HT		1	HT (HT1~HT12)	0.979	0.677~0.937	0.00	0.941	Reliable

Results of EFA exploratory factor analysis and regression correlation: EFA analysis for independent and dependent factors (Table 3) shows that KMO from 37 observed variables = 0.835 ≥ 0.5; Sig. Barlett's Test = 0.000 ≤ 0.05 is suitable for factor analysis. The variance data extracted in the Total Variance Explained table shows that four factors extracted from the independent variables explain 78.465% of the variation of the observed variables. This result is consistent with research regulations [21] requiring the extracted variance to reach 50% or more). The result of factor rotation analysis show that

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independent variables are classified into 5 main groups (Table 2): (i) VCP (TV1~TV4); (ii) VNN (TV6~TV9); (iii) VKD (TV11~TV15); (iv) HT (HT1~HT12); (v) TTH_{BIII} (TTH1~TTH7). The dependent variable is classified into 1 group of $BĐV_{BIII}$ (CCoB1, CCoB2, CCyB1, CCyB2, DSIB); The GSIB variable was eliminated because Vietnam does not have a global systemically important bank GSIB. The Pearson correlation coefficients (r) in Table 4 shows that the relationship between variables is relatively reasonable in direction and level. Most of correlation coefficient values ranges from 0.2 - 0.8, indicating that variables are linearly correlated. There is no correlation coefficient > 0.8, so multicollinearity does not occur.

Table 3.
KMO and Bartlett's Test /Total Variance Explained.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.							0.835			
Bartlett's Test of Sphericity				Approx. Chi-Square			8651.494			
				df			666			
				Sig.			.000			
Component		**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings**		
		Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
Dimension0	1	12.482	33.734	33.734	12.482	33.734	33.734	10.005	27.042	27.042
	2	6.125	16.554	50.288	6.125	16.554	50.288	5.074	13.713	40.754
	3	3.754	10.146	60.435	3.754	10.146	60.435	4.242	11.466	52.221
	4	3.401	9.193	69.627	3.401	9.193	69.627	3.742	10.114	62.335
	5	1.933	5.226	74.853	1.933	5.226	74.853	3.678	9.942	72.276
	6	1.336	3.612	78.465	1.336	3.612	78.465	2.290	6.189	78.465
	7	.824	2.226	80.691						
	....									
	37	0.015	0.041	100.000						
Extraction Method: Principal Component Analysis.										

Table 4.
Correlations/ Model Summary[a]/ ANOVA[b].

Variable	**Mean**	**Std0. Deviation**	**N**	**VCP**	**VNN**	**VKD**	**HT**	**TTH_{BIII}**	**BDV_{BIII}**
VCP	30.1597	0.87661	191	1					
VNN	20.4699	0.89887	191	0.409**	1				
VKD	30.5686	0.64780	191	0.311**	00.096	1			
HT	30.8521	0.71883	191	0.360**	0.148*	0.392**	1		
TTH_{BIII}	30.2087	0.83951	191	-0.309**	00.12	0.180*	-00.012	1	
BDV_{BIII}	20.0042	0.93403	191	0.474**	-00.025	0.335**	0.400**	-0.354**	1
R Square		0.412[a]							
Adjusted R Square		0.396[a]							
F /Sig.		25.926[b]/0.000[b]							

Note: **. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
a. Model Summary[a]: R Square; Adjusted R Square
b. ANOVA[b]: F/Sig.

Results of multivariate regression analysis using SPSS: According to the analysis data in Table 4, the Adjusted R Square coefficient of model (1) = 0.396 shows that independent variables are components of the capital increase solution and system-wide solution (VCP, VNN, VKD, HT, TTH_{BIII}) explains 39.6% of the variation in the dependent variable which is capital buffer according to Basel III ($BĐV_{BIII}$). This coefficient shows that the model's fit level is relatively high because normally in the social science, the Adjusted R Square coefficient = 0.25 is acceptable. Besides, the value Sig. = 0.000[b] of the model's F

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value is minor. This shows that model (1) fits the data set and can be generalized to the whole population.

The analysis result in Table 5 also show that VIF coefficients fluctuating in the range of 1.277 ~ 1.790 are all less than 10, so multicollinearity does not occur; Sig value. of variables shows that all 5 independent variables have a statistically significant relationship with the dependent variable (all 5 variables VCP, VNN, VKD, HT, TTH_{BIII} have Sig. ≤ 0.05). Therefore, the regression equation of model (1) is obtained as follows:

$$B\text{Đ}V_{BIII} = 0 + 0.313.VCP - 0.175.VNN + 0.215.VKD + 0.226.HT - 0.273\ TTH_{BIII}\ (1_{KQSPSS})$$

Table 5.
Coefficients[a].

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std0. Error	Beta			Tolerance	VIF
1	(Constant)	0.133	0.408		0.325	0.745		
	VCP	0.334	0.080	0.313	40.153	0.000	0.559	10.790
	VNN	-0.181	0.068	-0.175	-20.685	0.008	0.752	10.329
	VKD	0.311	0.095	0.215	30.274	0.001	0.734	10.362
	HT	0.293	0.083	0.226	30.541	0.001	0.783	10.277
	TTH_{BIII}	-0.303	0.073	-0.273	-40.163	0.000	0.742	10.348

Note: a. Dependent Variable: BDV_{BIII}; All requested variables entered: TTH_{BIII}, HT, VNN, VKD, VCP.

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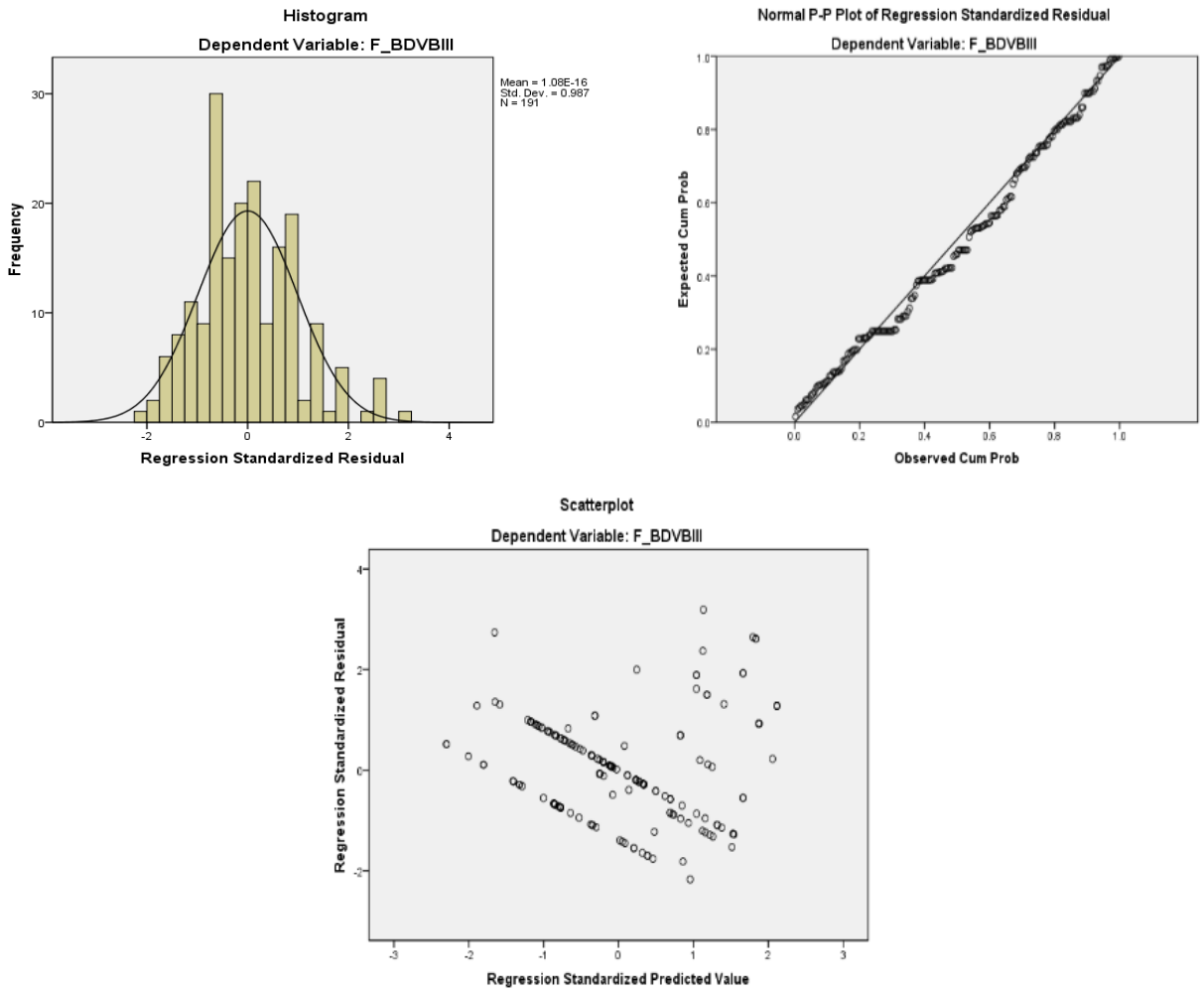

Figure 3.
Histogram, P-P Plot, Scatter Plot of the model.

Results of the sign analysis in the 1_{KQSPSS} equation show that: (i) Hypotheses H1, H3, H4, H5 are supported. In details, there is a statistically significant positive relationship between variables VCP, VKD, HT and the dependent variable $BĐV_{BIII}$; and there is a statistically significant negative relationship between variables TTH $_{BIII}$ and $BĐV_{BIII}$. The regression coefficient shows that when the variable VCP increases by 1 unit, keeping other independent variables unchanged, the average value of the dependent variable $BĐV_{BIII}$ increases by 0.313 times; variables VKD and HT also affect $BĐV_{BIII}$ at the corresponding levels of quantity and sign in the 1_{KQSPSS} model; (ii) Hypothesis H2 is not supported; specifically: The statistically significant negative relationship between variables VNN and $BĐV_{BIII}$ at the time of the survey seems to stem from tight budget conditions; The roadmap for increasing state capital by terms and annual limits over a long period of time is difficult to achieve immediately; some state-owned commercial banks are slow to equitize.

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6. Conclusion and Recommendations

The objective of the study is to investigate, survey and quantitatively analyze the relationship between the level of implementation of Basel III Capital Buffer and some solutions. The results of the study are as follows:

Firstly, this quantitative research has built a survey questionnaire and multivariate regression model 1_{KQSPSS} on the relation between "the level of implementation of Basel III capital buffers and a number of main implementation solutions", in which: (i) The level of implementation of the Basel III Capital Buffer ($BĐV_{BIII}$) is reflected through the level of implementation of the Capital Conservation Buffer (CCoB), Countercyclical Capital Buffer (CCyB), capital buffer of GSIB and DSIB; (ii) solutions targeted at Basel III Capital Buffer focus on five main groups: Group of solutions to increase capital related to securities (VCP); group of increase of state budget capital (VNN); group of increase of capital related to banking business activities (VKD); group of system solutions to manage and create infrastructure for banks to implement the Basel III Capital Buffer (HT); and group to solve difficulties and challenges in implementing the Basel III Capital Buffer at banks (TTH_{BIII}).

The results of testing using SPSS software show that the model 1_{KQSPSS}, although still in its infancy, has statistical significance, which can be a reference methodology for banking authorities to build models to assess the level of impact and effectiveness of solutions to: (i) Orient policies for banks to increase capital in accordance with their type, characteristics and nature of each type of bank; (ii) improve the inspection and supervision capacity of Basel III implementation for authorities; (iii) develop technology infrastructure, provide Basel III technology services by third parties (consulting units); (iv) develop a credit rating network, GSIB, DSIB ratings, audit consulting according to Basel III international practices; (v) overcome difficulties and challenges in implementing the Basel III Capital Buffer. Results of quantitative analysis and the direction of impact (positive or negative) of variables in the model also imply that the impact of variables may vary according to the implementation stage, the level of effectiveness of solutions and the way to overcome difficulties and challenges of banks when implementing the requirements of Basel III Capital Buffer. The survey questionnaire can also be a useful reference for banks in gap analysis of Basel Capital Buffer and assessing the level of implementation of solutions to make appropriate strategic adjustments towards the synchronous implementation of Basel III Capital Buffer at banks.

Second, results of the analysis of the regression model 1_{KQSPSS} from the research sample at the time of the survey showed that: (i) The partial regression coefficients of the independent variables VCP, VKD, HT have positive values, indicating the positive level and order of effectiveness of these solution variables in the model. The solution to increase stock capital has the most positive impact (VCK = 0.313); followed by the system solution HT = 0.226; and VKD = 0.215. Accordingly, banks need to focus on prioritizing positive solutions, aiming at optimizing and saving resources; (ii) The partial regression coefficient of the variable VNN = - 0.175 has a negative value, indicating a shortage in quantity, delay and prolonged time to increase budget capital, leading to a decrease in the effectiveness of the process of increasing budget capital to meet buffer requirements. This negative value also indicates the important role of the banking authorities in orienting development, supporting commercial banks to increase the volume and shorten the time to increase budget capital; (iii) The partial regression coefficient of the variable TTH_{BIII} = - 0.273 has a negative value, indicating that difficulties and challenges can slow down and hinder the implementation of the Basel III Capital Buffer. Accordingly, banks and banking authorities need to clearly identify and choose ways to resolve and overcome difficulties and challenges when implementing the Basel III Capital Buffer.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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