The Economics and Finance Letters
2025 Vol. 12, No. 2, pp. 231-250
ISSN(e): 2312-430X
ISSN(p): 2312-6310
DOI: 10.18488/29.v12i2.4185

Corporate governance and capital safety at Vietnamese joint stock commercial banks

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Article History
Received: 19 December 2024
Revised: 24 March 2025
Accepted: 8 April 2025
Published: 22 April 2025

Keywords
Bayes
Capital safety
Corporate governance
SGMM
Vietnamese commercial banks
Markov Chain Monte Carlo.

JEL Classification:
G21; M21; E58

ABSTRACT

This study evaluates the capital adequacy ratio (CAR) of Vietnamese commercial banks. Simultaneously, we assessed the impact of corporate governance on the capital adequacy ratio of Vietnamese joint stock commercial banks. We used SGMM and Bayesian methods to estimate models employing data from 28 Vietnamese commercial banks between 2012 and 2023. The findings indicated that variables including previous period CAR, deposit ratio, loan loss reserve, economic growth, board size, the share of female board members and educational qualifications significantly enhance the CAR of Vietnamese commercial banks. On the other hand, CAR exhibits a negative and statistically significant correlation with bank profitability, size, leverage ratio, non-performing loans, and CPI. We have recommended many policy implications to safeguard capital inside the Vietnamese commercial banking sector based on research findings.

Contribution/Originality: Our study significantly contributes to theory and methodology. Theoretically, it provides empirical evidence on the impact of corporate governance on ensuring CAR in Vietnamese commercial banks. Methodologically, the study enhances the robustness of findings by employing Bayesian analysis with the system-generalized method of moments (SGMM).

1. INTRODUCTION

In the 1970s, the financial crisis broke out with the collapse of commercial banks in developed countries. Because of the high risk, if the banking system is not well managed, it can fall into a state of increasing bad debt, liquidity stress, losses, and even bankruptcy leading to the collapse of the entire system, creating a financial crisis in the economy. In that context, the Bank for International Settlements (BIS) established the Basel Committee on Banking Supervision and issued the Basel Accord with standards to ensure the safety of banking operations. After more than 30 years of operation, the Basel Committee has issued Basel I, II, III and IV with stricter and more stringent changes in standards to ensure the safety of commercial banks. One of the important standards that banks need to comply with is the minimum capital adequacy ratio because this ratio is considered the main tool for the safety and soundness of the bank (Abiodun, Abdul-Azeez, & Adewale, 2020). The capital adequacy ratio (CAR) is an economic indicator that reflects the relationship between equity capital and risk-adjusted assets of a commercial bank. The CAR ratio is an important measure to assess the level of operational safety of a bank which has been dedicatedly built and developed by leading experts in the banking sector of the Basel Committee. Banks that ensure the minimum capital adequacy

ratio can withstand risks when they occur for sustainable development. The CAR ratio and the factors affecting the CAR ratio are always topics of interest to many researchers in the world. Research on factors affecting CAR has been conducted by many scholars under different conditions (El-Ansary & Hafez, 2015a; Mekonnen, 2015; Pham & Nguyen, 2017).

Previous studies have mainly focused on factors affecting CAR such as bank operating characteristics. However, studies have not been conducted on corporate governance factors. Banking practice shows that the role of the management board is crucial in determining capital structure, risk management and banking performance. In addition, the role of governance in banking operations has been empirically proven in various previous studies (Ali, Hussain, & Iqbal, 2021; Anginer, Demirguc-Kunt, Huizinga, & Ma, 2018; Chitan, 2012).

Vietnam is a developing country. The stock market is not yet strongly developed, so commercial banks play a crucial role in the Vietnamese financial system. After a period of prosperous development, the Vietnamese banking system was affected by the global financial crisis in 2008 as well as the COVID-19 pandemic. The Vietnamese commercial banking system has revealed many weaknesses such as a high bad debt ratio, low liquidity, and small banks operating at a loss (Pham & Nguyen, 2017). Therefore, the issue of capital adequacy of Vietnamese commercial banks has always received the attention of policymakers and scholars. Although studies on this topic in Vietnam are increasing, some research gaps still need to be filled, such as a better understanding of the impact of corporate governance (such as board composition, diversity and independence) on the capital adequacy of Vietnamese commercial banks.

Furthermore, in terms of estimation methods, inferences about research results based on p-values have been criticized by scholars in recent years (Wasserstein & Lazar, 2016). This issue raises questions about the robustness of frequency-based estimation results. Therefore, current studies often use a dual approach, combining SGMM with Bayesian analysis to provide frequency and probability details of the estimation results. This approach provides more comprehensive, robust, and reliable findings.

The main goal of this study is to investigate how corporate governance affects the CAR of Vietnamese joint stock commercial banks from 2012 to 2023. By investigating how board size, composition, gender diversity, and other governance variables may affect the capacity of these banks to maintain adequate levels of capital, the study aspires to shed new light on the governance–finance relationship. The key questions addressed are as follows: (i) How do corporate governance and capital adequacy assurance of Vietnamese commercial banks influence each other? (ii) What policy implications can be drawn to enhance capital adequacy in this context?

From a practical standpoint, findings from this study are expected to benefit regulators and bank executives in Vietnam. As the central bank (i.e., the State Bank of Vietnam (SBV)) continues to refine regulatory frameworks for more stringent capital requirements, more profound understanding of the governance factors that facilitate—or hinder—banks in meeting these requirements becomes indispensable. Banks themselves can leverage these insights to restructure their boards and refine governance practices, thereby strengthening their financial soundness. From a theoretical perspective, this investigation contributes to corporate finance and governance theories by extending the discourse on the agency, stakeholder, and information theories, particularly in an emerging market context. Methodologically, the incorporation of Bayesian analysis complements traditional econometric techniques, offering more holistic evidence for policy prescriptions and strategic decision-making.

This paper is organised as follows: The scientific literature is summarised in section 2 with a focus on research on bank capital adequacy and governance. The research approach we used for this study is presented in section 3. The empirical results are reported in section 4, and a thorough discussion and assessment of the results' implications are provided in section 5. A review of the major contributions and suggestions for the next study directions are provided in section 6, which brings the work to a close.

2. LITERATURE REVIEW

Many scholars worldwide have studied corporate governance, including concepts, measurement methods, and importance in the business operations of organizations. Cadbury (1992) defines corporate governance as a framework that ensures a company operates effectively. Shleifer and Vishny (1997) emphasize its role in ensuring profits for investors, shareholders, and stakeholders in the company. Similarly, Ibadin, Izedonmi, and Ibadin (2012) argue that corporate governance is a set of management rules that control the company's input resources to create outputs. Shukeri and Islam (2012) emphasize that corporate governance plays an important role in ensuring the sustainability of the company's operations.

In recent years, many empirical studies have explored the factors affecting the CAR of commercial banks. Nuviyanti and Anggono (2014) found a statistically significant impact of operating costs and non-performing loans on the CAR in Indonesian banks. In a study of Southeast European countries, Aktas, Acikalin, Bakin, and Celik (2015) found a statistically significant impact of bank size, profitability, and financial leverage on CAR of banks in these countries.

El-Ansary and Hafez (2015b) found that asset size and risk provisioning negatively affected CAR in Egyptian banks. Similarly, Shingjergji and Hyseni (2015) found similar results in Albania, emphasizing liquidity and credit quality. Although many factors have been found to influence CAR of commercial banks in many countries, these studies have not considered the impact of corporate governance on CAR in their models.

A study that addresses the impact of corporate governance on CAR of commercial banks is Masood and Ansari (2016). Masood and Ansari (2016) demonstrated the negative impact of ownership concentration on the CAR in Pakistan, raising questions about the interaction between governance practices and financial resilience. Subsequently, Alyousef and Hewaidi (2018) found a statistically significant effect of management quality on CAR in Kuwaiti banks. Although the role of corporate governance in relation to CAR of commercial banks was mentioned, these studies approached corporate governance from the perspective of the general concept of governance without paying attention to the governance structure of banks.

Usman, Lestari, and Puspa (2019) and Abiodun et al. (2020) found factors affecting the CAR of commercial banks but did not address the moderating role of governance in these relationships in studies of the banking system in Indonesia and Nigeria.

Thus, it can be seen that there are still some limitations in previous studies related to the impact of corporate governance on the CAR of commercial banks. Besides, corporate governance not only helps commercial banks manage risks better but also helps improve operational efficiency. Berger, Kick, and Schaeck (2014) found evidence showing a statistically significant impact of board diversity and expertise on the stability and performance of banks.

Agustina et al. (2021) found no significant impact of governance on CAR in Indonesian banks, highlighting the inconsistency in results in previous studies although the results of most studies show a statistically significant impact of corporate governance on CAR of commercial banks. These inconsistencies suggest that the impact of corporate governance on CAR of commercial banks may vary depending on the research conditions.

The gaps and inconsistencies in previous studies have shown that the study of the impact of corporate governance on CAR of commercial banks still needs to be further studied, especially in emerging markets such as Vietnam. Specifically, the interaction between corporate governance and capital adequacy is often more pronounced in emerging markets due to the lack of institutional maturity, regulatory enforcement, and information asymmetry. State-owned or privately controlled banks in such a context may face greater governance challenges, including concentrated ownership and less transparent decision-making processes. These conditions may impede a bank's ability to comply with stringent capital requirements, particularly during periods of financial stress.

3. RESEARCH METHODOLOGY

3.1. Hypothesis Development

3.1.1. Board Size Characteristics (BOARDS)

The board size variable is measured by the number of board members of a commercial bank. Previous studies show that the board of directors plays an important role in guiding the stable development of a bank. According to Berger et al. (2014); Chan, Koh, and Karim (2016) and Pathan (2009) a large board of directors will help better monitor the CEO's influence and help protect the interests of shareholders based on agency theory. A large number of board members will increase the bank's ability to monitor, inspect and manage risks. At the same time, the board of directors can increase business performance by performing the monitoring function well. This has been empirically proven in the study of the relationship between the number of board members and bank risk by Chan, Koh, and Karim (2016) and Pathan (2009). Therefore, the study expects a positive relationship between the CAR ratio and the bank's board of directors' size.

Hypothesis H_1: The size of the board of directors has a positive impact on CAR.

3.1.2. Ratio of Independent Directors in the Board of Directors (INDEPB)

When referring to the board of directors of a bank, the term "proportion of independent directors" refers to the percentage of board members that are independent. The calculation of this percentage is accomplished by determining the proportion of independent directors to the total number of board members for a certain financial institution. Independent directors provide substantial contributions to the settlement of agency problems and conflicts of interest as well as to the strengthening of the quality of monitoring which ultimately helps to decrease risks for shareholders and banks. These contributions are made possible by the establishment of independent directors. According to Chan et al. (2016) the capacity of the board to manage risks, particularly credit risk is significantly enhanced when there is a bigger proportion of independent directors on the board. This is especially true at the credit risk level. As a result, the results of this study suggest that CAR is positively correlated with a larger percentage of independent directors on the board.

Hypothesis H_2: The proportion of independent directors on the board positively impacts the CAR ratio.

3.1.3. Proportion of Women on the Board (FEMALEB)

This index is a representation of the percentage of women who serve on the board of directors of a financial institution. It is determined by calculating the ratio of female directors to the total number of board members. Carter, Simkins, and Simpson (2003) and Erhardt, Werbel, and Shrader (2003) found that gender diversity, especially with higher female involvement was associated with better bank performance. This was shown by the findings of these studies. It has been shown through studies conducted by Agnew, Balduzzi, and Sunden (2003); Barsky, Juster, Kimball, and Shapiro (1997); Jianakoplos and Bernasek (1998) and Sunden and Surette (1998) that women tend to have a higher level of risk aversion than males do when it comes to making decisions about their finances. In addition, Almazan and Suarez (2003) propose that women provide powerful monitoring incentives, which in turn reduce the risks that banks face. According to Salim, Arjomandi, and Seufert (2016) a larger number of female directors in Australian banks from 1999 to 2013 increased profitability and cost efficiency while also reducing risks. This finding lends support to the claims made in the previous sentence. Accordingly, the results of this study suggest the CAR of commercial banks is positively impacted by a larger percentage of women on the board of directors.

Hypothesis H_3: The proportion of women on the board of directors positively impacts the CAR ratio.

3.1.4. Foreigners on the Board of Directors (FOREIGNB)

The percentage of a bank's board of directors that is made up of international members in contrast to the whole number of members is referred to as the proportion of international members to the total number of members. It is

believed that introducing international members will enhance the board's ability to supervise as they provide a foreign experience, worldwide relationships, and the application of innovative management techniques and technological advancements. Dong, Girardone, and Kuo (2017) discovered that there is an inverse relationship between the percentage of foreign members and the level of risk which is a factor that helps the stability of the bank. Consequently, this indicates that the percentage of members from other countries is negative. This study forecasts that there will be a positive relationship between this ratio and the CAR ratio.

Hypothesis H_8: The proportion of foreigners on the board of directors positively impacts the CAR ratio.

3.1.5. Board Education (EDUB)

The percentage of board members who possess postgraduate degrees is used as a measurement of board education. This proportion is computed by dividing the total number of board members for a certain bank and year by the number of board members who hold postgraduate degrees. According to Graham and Harvey (2001) there is a relationship between the education of a company's board of directors and the financing strategy of the company. This correlation suggests that CEOs who have advanced degrees are more likely to use complex valuation tools, such as the capital asset pricing model (CAPM) to estimate the cost of capital. These innovative approaches enhance decision-making and contribute to a reduction in the total risk that the company faces. Consequently, it is anticipated that board members who possess a high level of education would have a good impact on the strategic and financial resilience of a bank.

Hypothesis H_9: The educational level of the board members has a positive impact on the CAR coefficient.

3.2. Research Model

This study employs the model to evaluate capital adequacy assurance through CAR of Vietnamese commercial banks from 2012 to 2023. The model is based on the theoretical foundation and relevant previous empirical investigations.

$$CAR_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 SIZE_{it} + \beta_3 LIQ_{it} + \beta_4 DEP_{it} + \beta_5 LOA_{it} + \beta_6 LEV_{it} + \beta_7 LLR_{it} + \beta_8 NPL_{it} + \beta_9 GDP_t + \beta_{10} CPI_t + \beta_{11} BOADS_{it} + \beta_{12} INDEPB_{it} + \beta_{13} FEMALEB_{it} + \beta_{14} FOREIGNB_{it} + \beta_{15} EDUB_{it} + \varepsilon_{it} \quad (1)$$

Where, i represents the i_th bank, t represents the t_th year, and ε is the residual in the model.

Based on previous studies, this study examines the effects of macroeconomic factors and internal bank factors on the CAR of Vietnamese commercial banks. Table 1 presents comprehensive details regarding the variables.

Table 1. Information about the variables in the research model.

Variables	Code	Measures	Rationale for variable selection
Dependent variable			
Capital adequacy ratio	CAR	Equity/ Total risk-adjusted assets	(Abiodun et al., 2020; El-Ansary & Hafez, 2015a; Nuviyanti & Anggono, 2014; Ünvan, 2020).
Independent variables			
Profitability	PRO	(Net income after tax/ Total assets) x 100	(Agustina et al., 2021; Anginer et al., 2018; El-Ansary & Hafez, 2015a).
Bank size	SIZE	Natural logarithm of total assets	(Abiodun et al., 2020; Ali et al., 2021; Ünvan, 2020; Usman et al., 2019).

Variables	Code	Measures	Rationale for variable selection
Liquidity ratio	LIQ	The ratio of liquid assets to total assets	(Mekonnen, 2015).
Deposit ratio	DEP	The amount of total deposits held by a bank to total assets	(Büyükkşalvarcı & Abdioğlu, 2011; Mekonnen, 2015).
Loan-to-asset ratio	LOA	A ratio of total loans to total assets	(Ali et al., 2021; El-Ansary & Hafez, 2015a; Mekonnen, 2015).
Leverage ratio	LEV	Total liabilities/ Total equity	(Mekonnen, 2015; Ünvan, 2020; Usman et al., 2019).
Loan loss reserve	LLR	(Loan loss reserves/ Total loans) x 100	(El-Ansary & Hafez, 2015a; Mekonnen, 2015; Usman et al., 2019).
Non-performing loan	NPL	The ratio between non-performing loans to total loans	(Shingjergji & Hyseni, 2015; Usman et al., 2019).
Economic growth	EG	(EGt – EGt-1)/EGt-1	(Abiodun et al., 2020; Akande & Olorunfemi, 2016).
Consumer price index	CPI	Annual inflation rate of a country	(Abiodun et al., 2020; Akande & Olorunfemi, 2016).
Board size	BOARDS	Number of board members	(Adams & Ferreira, 2009; Berger et al., 2014; Dong et al., 2017; Salim et al., 2016).
The ratio of independent members on the board of directors	INDEPB	Number of independent members/ Total number of members of the board of directors	(Chan et al., 2016; Dong et al., 2017; Salim et al., 2016).
The share of female board members	FEMALEB	Number of female board members/Total number of board members	(Adams & Ferreira, 2009; Berger et al., 2014; Dong et al., 2017).
Percentage of foreign members on the board of directors	FOREIGNB	Number of foreign board members/ Total number of board members	(Dong et al., 2017).
Educational qualifications of board members	EDUB	Number of members with postgraduate qualifications/ Total number of board members	(Berger et al., 2014; Graham & Harvey, 2001).

3.3. Research Data

This study utilizes a sample of 28 Vietnamese commercial banks from 2012 to 2023. The selection of these banks is justified by their significant market positions and the fact that their total assets constitute the majority of the Vietnamese commercial banking sector. The chosen research period ensures the availability of complete and

consistent data for calculating CAR across all 28 banks, resulting in a balanced panel dataset comprising 336 observations.

For empirical analysis, the study employs traditional panel data regression techniques, including fixed effects model (FEM), random effects model (REM), and feasible generalized least squares (FGLS). Additionally, the system generalized method of moments (SGMM) is applied to address endogeneity issues, particularly when lagged variables are present in the model.

These methods often rely on inference through p-values to draw conclusions about research hypotheses despite their widespread use. However, the reliance on p-values has been subject to extensive criticism (Wasserstein & Lazar, 2016) due to their limitation as conditional probabilities. Specifically, p-values indicate the likelihood of observing the data given that the hypothesis is true but fail to quantify the probability of the hypothesis itself being true.

Bayesian analysis is incorporated as a complementary approach to overcome this limitation. Unlike p-values, Bayesian analysis provides direct probabilities for the hypotheses, offering greater interpretability and robustness. In this study, Bayesian analysis supplements the SGMM estimates, ensuring the reliability and robustness of the findings.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

Table 2 shows the statistical values of the variables in the model. The total number of observations for each variable is 336. According to Table 2, Vietnamese commercial banks are affected by banks with low CAR ratios. The mean value of the CAR variable is 13.63% and the maximum value of CAR is 17.8%. The average PRO over the past twelve years of Vietnamese commercial banks is 1.11%, and the standard deviation is 1.13%. In terms of return on assets (PRO), the lowest value is 0.1% while the largest value is 8.4%. This shows that there is a gap in profitability among Vietnamese commercial banks. However, most banks can meet the minimum capital standards set by Basel. For bank size, the mean and standard deviation of the natural logarithm of total assets are 7.97 and 0.51, respectively. This figure shows that the bank size in the sample varies widely and is somewhat representative. In addition, the descriptive statistics of the remaining variables (LIQ, DEP, LOA, LEV, LLR, NPL, GDP, CPI, BOARDS, INDEPB, FEMALEB, FOREIGNB and EDUB) are within reasonable values.

Table 2. Descriptive statistics.

Variables	Obs.	Mean	Std. dev.	Min.	Max.
CAR	336	0.136	0.015	0.093	0.178
PRO	336	0.011	0.011	0.001	0.084
SIZE	336	7.974	0.515	6.522	9.173
LIQ	336	0.188	0.093	0.045	0.61
DEP	336	0.629	0.129	0.123	0.894
LOA	336	0.544	0.127	0.145	0.808
LEV	336	11.394	4.842	2.008	33.113
LLR	336	0.011	0.008	0.001	0.054
NPL	336	0.023	0.017	0.002	0.126
GDP	336	5.928	1.128	2.91	7.08
CPI	336	5.911	4.603	0.63	18.58
BOARDS	336	8.378	2.310	4	17
INDEPB	336	0.371	0.079	0.09	0.456
FEMALEB	336	0.319	0.164	0.071	0.857
FOREIGNB	336	0.305	0.146	0.083	0.833
EDUB	336	0.322	0.164	0.067	0.833

Table 3 emphasizes research model variable correlations. LOA and NPL are not statistically significant although most independent factors are associated and significant with CAR. CAR is most negatively correlated with SIZE (-

0.5501) and positively correlated with DEP (0.0961). The correlation coefficients between variables are usually -0.626 to 0.6492. This means the research model is unlikely to have multicollinearity.

4.2. Main Findings

Table 4 displays the outcomes of the panel regression analysis that was conducted using FEM and REM. In the FEM model, CAR is positively and significantly influenced by the variables DEP, LLR, GDP, BOARDS, FEMALEB, and EDUB. These variables work together to produce the CAR. A negative and substantial relationship exists between CAR and the variables PRO, SIZE, LIQ, LOA, LEV, NPL, and CPI. Meanwhile, CAR is a significant variable. Other factors, such as INDEPB and FOREIGNB have an influence on the bank's CAR ratio, which is both negative and positive. Nevertheless, these findings do not meet the criteria for statistical significance. The findings of the regression in the REM model are relatively comparable to those in the FEM model in terms of the direction of the impact of independent factors on CAR. The only difference is that the variable INDEPB in the REM model positively impacts CAR but this impact is not statistically significant.

Table 3. Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) CAR	1															
(2) PRO	-0.346***	1														
(3) SIZE	-0.550***	0.003	1													
(4) LIQ	-0.261***	-0.012	-0.249***	1												
(5) DEP	0.096*	-0.096*	0.380***	-0.553***	1											
(6) LOA	0.080	-0.054	0.274***	-0.626***	0.598***	1										
(7) LEV	-0.481***	-0.039	0.649***	-0.148***	0.299***	0.128**	1									
(8) LLR	0.217***	0.044	0.178**	-0.215***	0.060	0.042	-0.120**	1								
(9) NPL	0.001	-0.002	0.041	0.005	-0.020	-0.026	-0.055	0.188***	1							
(10) GDP	0.140**	0.016	0.034	-0.087	0.029	0.015	0.071	0.035	0.048	1						
(11) CPI	-0.333***	0.124**	-0.255***	0.397***	-0.559***	-0.356***	-0.235***	-0.122**	-0.120**	-0.108**	1					
(12) BOARDS	-0.188***	-0.063	0.488***	-0.133**	0.205***	0.344***	0.201***	0.037	-0.027	-0.109**	-0.181***	1				
(13) INDEPB	0.099*	-0.048	0.225***	-0.204***	0.240***	0.078	0.124**	0.140**	0.052	-0.059	-0.144***	0.1686***	1			
(14) FEMALEB	0.191***	-0.069	0.204***	-0.134**	0.264***	0.148***	0.157***	0.243***	0.051	0.098*	-0.320***	-0.2209***	0.272***	1		
(15) FOREIGNB	0.124**	-0.060	0.095*	-0.052	0.029	-0.079	0.043	0.136**	-0.037	0.092*	-0.114**	-0.2692***	0.094*	0.254***	1	
(16) EDUB	0.321***	-0.027	0.249***	-0.252***	0.284***	0.196***	0.231***	0.229***	0.062	0.134**	-0.471**8	-0.1728***	0.223***	0.498***	0.427	1

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Regression results for Equation 1 by FEM and REM.

Variables	FEM				REM			
	Coeff.	Std. err.	t	p_value	Coeff.	Std. err.	t	p_value
PRO	-0.415	0.019	-22.190	0.000	-0.414	0.019	-22.180	0.000
SIZE	-0.018	0.002	-11.430	0.000	-0.020	0.001	-16.060	0.000
LIQ	-0.050	0.004	-13.260	0.000	-0.050	0.004	-13.620	0.000
DEP	0.008	0.003	2.640	0.009	0.006	0.003	2.250	0.024
LOA	-0.017	0.003	-5.170	0.000	-0.016	0.003	-5.200	0.000
LEV	-0.001	0.000	-10.110	0.000	-0.001	0.000	-9.880	0.000
LLR	0.288	0.032	8.890	0.000	0.287	0.032	8.950	0.000
NPL	-0.055	0.012	-4.450	0.000	-0.055	0.012	-4.390	0.000
GDP	0.002	0.000	8.860	0.000	0.002	0.000	8.910	0.000
CPI	0.000	0.000	-5.830	0.000	0.000	0.000	-6.760	0.000
BOARDS	0.002	0.000	10.790	0.000	0.002	0.000	11.350	0.000
INDEPB	-0.001	0.003	-0.380	0.707	0.002	0.003	0.740	0.457
FEMALEB	0.014	0.002	6.150	0.000	0.013	0.002	6.060	0.000
FOREIGNB	0.001	0.002	0.680	0.496	0.001	0.002	0.590	0.555
EDUB	0.030	0.002	13.440	0.000	0.031	0.002	14.440	0.000
_CONS	0.265	0.011	25.050	0.000	0.284	0.009	32.680	0.000
R-squared	0.899				0.897			
Adj.R-squared	0.881				0.897			
Prob F-stat	0.000				0.000			

The Hausman test was used in this study to evaluate the FEM model in comparison to the REM model. This was done to choose the appropriate estimate for the model. The Hausman evaluation findings presented in Table 5 demonstrate that the REM model is better than the FEM model due to the fact that the value of prob>chi2 = 0.4613 is greater than 5%. As a result, the estimation of the REM model serves as the foundation for the analysis undertaken in this work.

Table 5. Hausman test.

Criteria	Chi-square	Prob> chi-square
Cross-section random	14.86	0.4613

The essential tests were carried out to discover issues in the REM estimation model within the scope of the study. The p-value which is less than 5% indicates that the REM model has heteroscedasticity as indicated by the results of the Breusch and Pagan test, which are presented in Table 6. At the same time, the Wooldridge test in Table 7 reveals that the REM model has an autocorrelation phenomenon as shown by the probability value of 0.0000, which is less than the threshold of 5%.

Table 6. Breusch and Pagan Lagrangian multiplier test for random effects.

Criteria	Chi-square	Prob> chi squared
Cook-Weisberg test for heteroskedasticity	317.41	0.0000

Table 7. Wooldridge test for autocorrelation in panel data.

Criteria	F	Prob>F
Autocorrelation in panel data	24.440	0.0000

The panel data model has heteroscedasticity and autocorrelation. The feasible generalized least squares (FGLS) estimation method is chosen (Wooldridge, 2010). However, in economic research models with panel data with lags and frequent endogeneity, the FEM, REM, and FGLS regression methods often lead to inaccurate estimation of regression coefficients. In that case, the system GMM estimation method is preferred to overcome the model's defects

(Blundell & Bond, 1998). The regression results using the FGLS estimation method in Table 8 show that, of the 15 independent variables tested, 13 variables have an impact and are statistically significant on the CAR of Vietnamese commercial banks at the significance level from 1% to 5%. The two variables INDEPB and FOREIGNB have positive and negative effects on the CAR ratio of banks but are not statistically significant at all three significance levels of 1%, 5% and 10%.

Table 8. Regression results for Equation 1 by FGLS estimators.

Variables	Coeff	Std.err.	z	p_value
PRO	-0.416	0.009	-44.870	0.000
SIZE	-0.022	0.001	-39.390	0.000
LIQ	-0.048	0.002	-24.870	0.000
DEP	0.004	0.002	2.170	0.030
LOA	-0.016	0.002	-8.480	0.000
LEV	-0.001	0.000	-14.500	0.000
LLR	0.301	0.018	16.510	0.000
NPL	-0.065	0.008	-8.320	0.000
GDP	0.001	0.000	12.750	0.000
CPI	0.000	0.000	-12.110	0.000
BOARDS	0.002	0.000	17.310	0.000
INDEPB	0.002	0.002	1.320	0.188
FEMALEB	0.015	0.001	13.330	0.000
FOREIGNB	-0.001	0.001	-0.900	0.369
EDUB	0.035	0.001	30.840	0.000
_CONS	0.304	0.004	75.210	0.000
Wald chi2	8877.150			
Prob > chi2	0.000			

The results of Equation 1 are presented in Table 9 using the SGMM estimate approach. These findings demonstrate that the lagged exact parameter (CAR L1) is positive as determined by the SGMM model computation. This indicates that the prior CAR directly and positively influences the current CAR. At the 1% significance level, BOARDS, FEMALEB, and EDUB favourably influence the CAR of Vietnamese commercial banks. This is the case for the five independent variables that are connected to corporate governance. In light of this, the hypotheses H1, H3, and H5 are acceptable for this investigation. There is a negative relationship between the CAR of the bank and the remaining two variables, INDEPB and FOREIGNB. However, these variables do not meet the criteria for statistical significance at any of the three levels of significance: 1%, 5%, or 10%. It may be deduced from this that the hypotheses H2 and H4 are not accepted. In addition, the findings of the research indicate that the DEP, LLR, and GDP all have a favourable influence on the CAR ratio of banks at the 5% significant level. At a significance level of 1%, the research also discovered that there is a negative and significant relationship between the CAR ratio of banks and the variables PRO, SIZE, LIQ, LOA, LEV, NPL, and CPI. This relationship was determined to be particularly significant.

Additionally, the findings of the estimations made with the SGMM method which takes into account the endogeneity in the model are shown to be trustworthy in Table 9. The findings suggest that the p-value of AR (1) is lower than the 5% level of significance. There is a correlation between the instrumental factors and the endogenous variables. At the same time, the p-value of AR (2) is higher than the significance level of 5% which indicates that the instrumental variables do not have a connection with the residuals of the model. This indicates that the instruments that were chosen are suitable. In addition, the p-value of the Hansen test is 0.564, which is higher than the significance limit of 5%. This indicates that the number of instrumental variables that were utilised is appropriate. Therefore, the estimation findings that were achieved through the SGMM approach are trustworthy.

Table 9. Regression results for Equation 1 by SGMM estimators.

CAR	Coeff.	Std. err.	t	P_value
CAR L1.	0.115	0.026	4.400	0.000
PRO	-0.427	0.014	-29.700	0.000
SIZE	-0.020	0.001	-25.890	0.000
LIQ	-0.048	0.002	-19.760	0.000
DEP	0.004	0.002	2.240	0.033
LOA	-0.017	0.002	-9.030	0.000
LEV	-0.001	0.000	-11.260	0.000
LLR	0.189	0.060	3.180	0.004
NPL	-0.044	0.010	-4.420	0.000
GDP	0.001	0.000	14.730	0.000
CPI	-0.001	0.000	-13.690	0.000
BOARDS	0.001	0.000	11.050	0.000
INDEPB	-0.002	0.002	-0.950	0.353
FEMALEB	0.012	0.002	6.440	0.000
FOREIGNB	-0.001	0.001	-0.970	0.339
EDUB	0.030	0.002	13.060	0.000
_CONS	0.283	0.007	39.180	0.000
F	4787.410			
Prob > F	0.000			
The p_value of the Arellano-Bond test for AR (1): 0.001				
The p_value of the Arellano-Bond test for AR (2): 0.117				
The p_value of the Hansen test of overid. restrictions: 0.564				

4.3. Robustness Tests

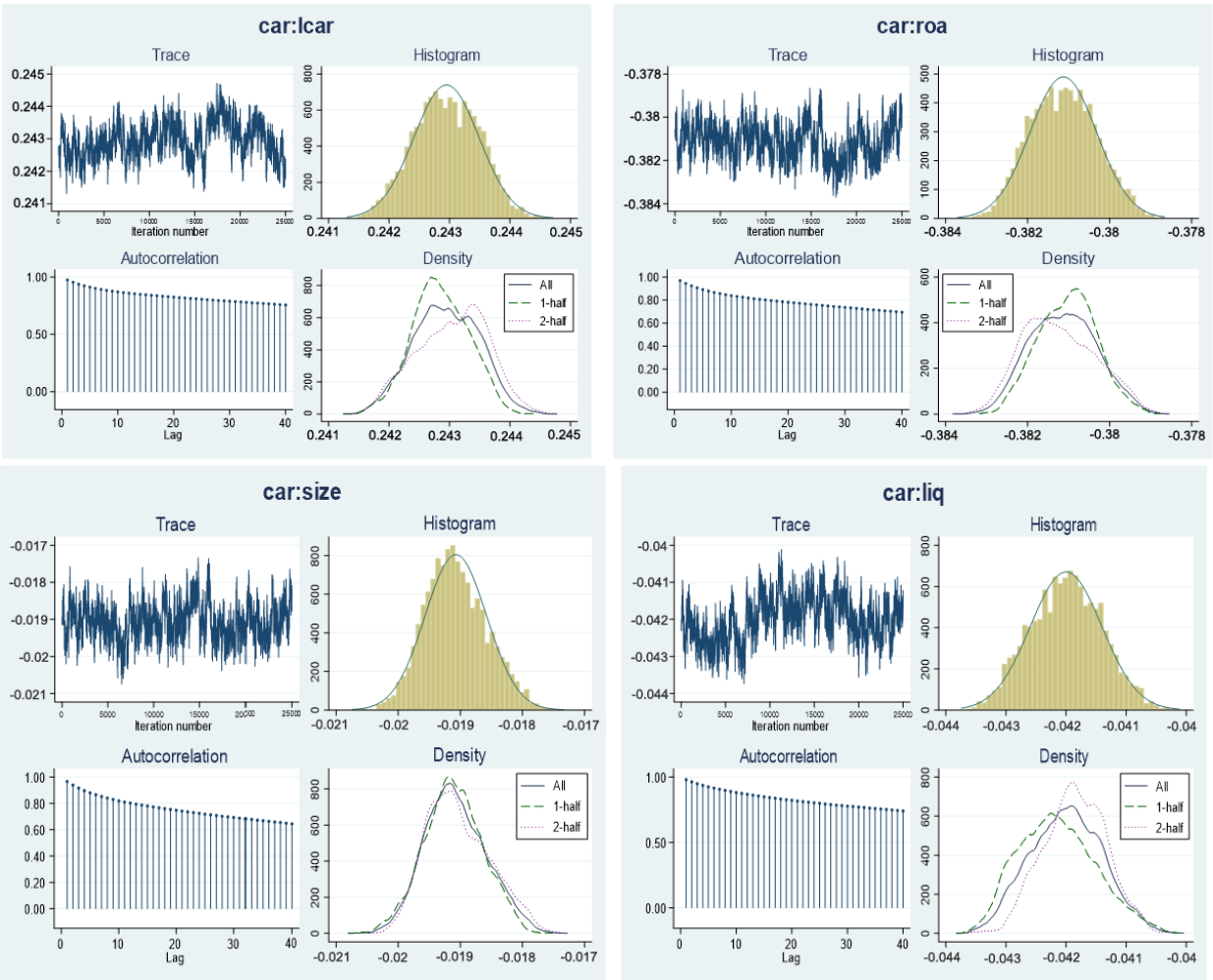
As emphasized earlier, inferences based on p-values have faced certain criticisms. Therefore, we proceed with Bayesian analysis as a tool to test the robustness of the estimation results obtained from SGMM to ensure the reliability of the results in this study.

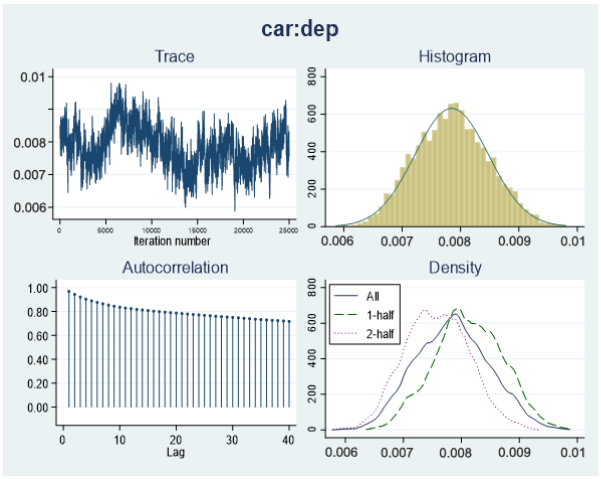
Table 10. Bayesian normal regression results.

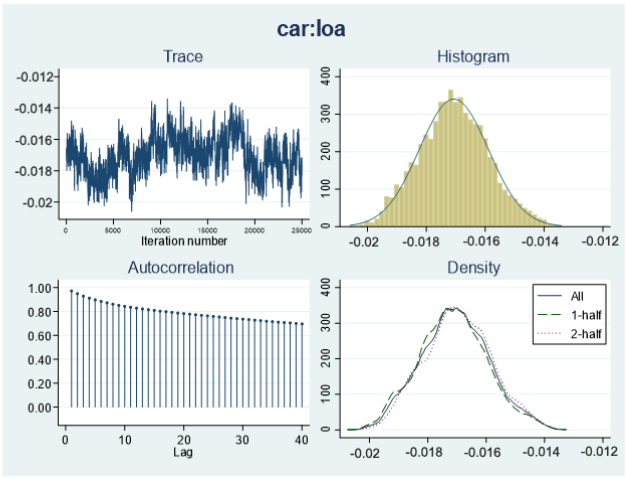
Variables	Mean	Std.dev.	MCSE	Median	[95% cred. interval]	
CAR						
LCAR	0.2399	0.0021	0.0004	0.2398	0.2362	0.2440
PRO	-0.3755	0.0016	0.0003	-0.3755	-0.3786	-0.3725
SIZE	-0.0196	0.0005	0.0001	-0.0196	-0.0205	-0.0187
LIQ	-0.0472	0.0022	0.0003	-0.0471	-0.0516	-0.0429
DEP	0.0066	0.0009	0.0002	0.0067	0.0049	0.0079
LOA	-0.0190	0.0009	0.0002	-0.0191	-0.0205	-0.0174
LEV	-0.0007	0.0001	0.0000	-0.0007	-0.0008	-0.0006
LLR	0.2277	0.0012	0.0002	0.2277	0.2254	0.2301
NPL	-0.0385	0.0007	0.0001	-0.0384	-0.0402	-0.0375
GDP	0.0012	0.0001	0.0000	0.0012	0.0010	0.0013
CPI	-0.0005	0.0000	0.0000	-0.0005	-0.0006	-0.0004
BOARDS	0.0015	0.0001	0.0000	0.0015	0.0013	0.0017
INDEPB	-0.0024	0.0012	0.0002	-0.0024	-0.0047	0.0000
FEMALEB	0.0093	0.0007	0.0001	0.0093	0.0081	0.0107
FOREIGNB	-0.0004	0.0008	0.0001	-0.0005	-0.0020	0.0010
EDUB	0.0252	0.0018	0.0003	0.0256	0.0212	0.0283
_CONS	0.2505	0.0031	0.0005	0.2505	0.2447	0.2564
VAR_U	0.0009	0.0003	0.0000	0.0008	0.0005	0.0015
SIGMA2	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001
Number of groups: 28						
Number of obs: 308						
Acceptance rate: 0.6334						
Efficiency: Min = 0.001214; avg= 0.08762; max=1						

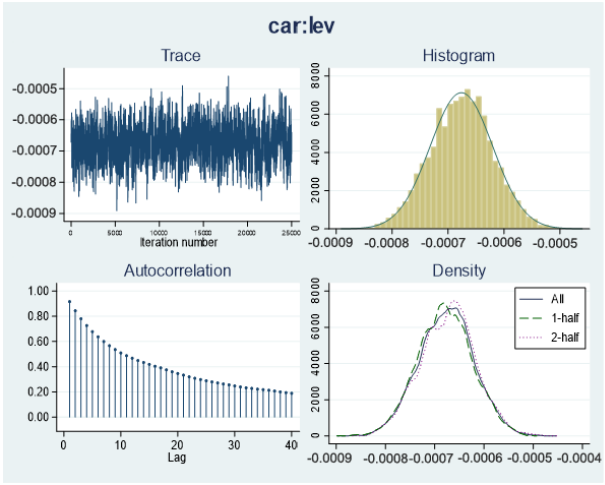
The posterior mean estimate for SIGMA2 is 0.0001 which is close to the residual mean square estimate of 0.0001 as shown by the results of the Bayesian which can be found in Table 10 and the posterior diagnostic plot for the explanatory variables in the research model which can be seen in Figure 1. The Bayesian estimates presented in this paper are derived based on a Markov Chain Monte Carlo (MCMC) sample size of 25,000. Figure 1 demonstrates the MCMC chains that correspond to the regression coefficients in the model bounce about the posterior mean of each coefficient without exhibiting any trend of growth or decrease regarding the problems associated with convergence. The autocorrelation plot reveals a decreasing correlation, with all values falling below 0.8. It can be seen from the histogram that the posterior distribution of the regression coefficients is quite close to being identical to a normal distribution. Therefore, it is possible to conclude that the MCMC chains corresponding to the posterior regression coefficients belong to the convergent category.

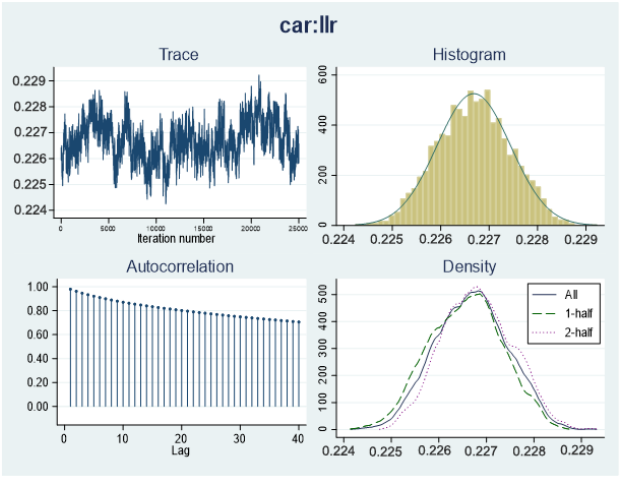
Table 10 shows that the posterior mean values of the regression coefficients corresponding to the variables BOARDS, FEMALEB, and EDUB are positive with their respective 95% credible intervals lying entirely within the positive domain, as both the lower and upper bounds are greater than 0. Thus, Bayesian analysis results indicate that the variables BOARDS, FEMALEB, and EDUB have a positive impact on the dependent variable CAR. This result is consistent with the estimation results obtained from the SGMM method. Additionally, the posterior mean values of the coefficients for INDEPB and FOREIGNB are positive but their 95% credible intervals span both positive and negative values. This suggests an ambiguous effect of these two variables on the dependent variable CAR.

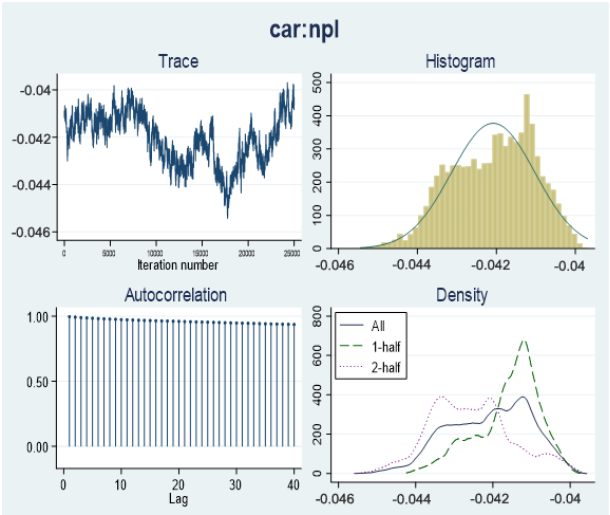


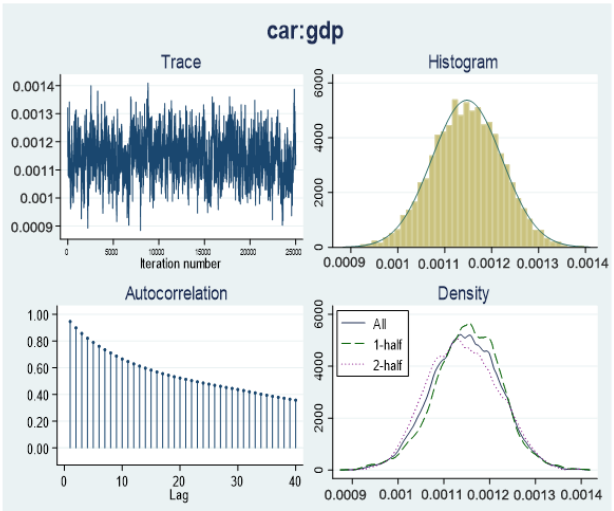


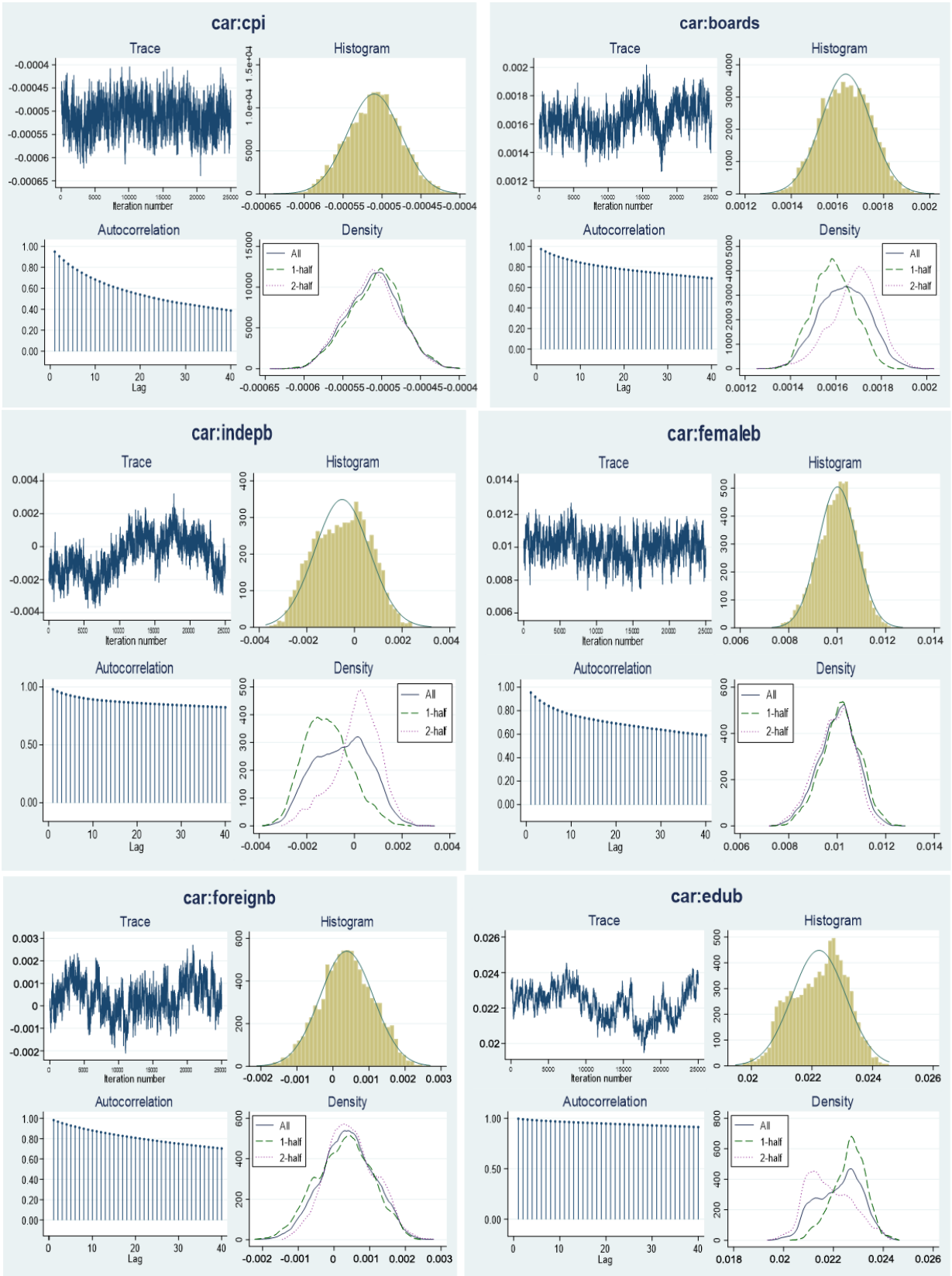












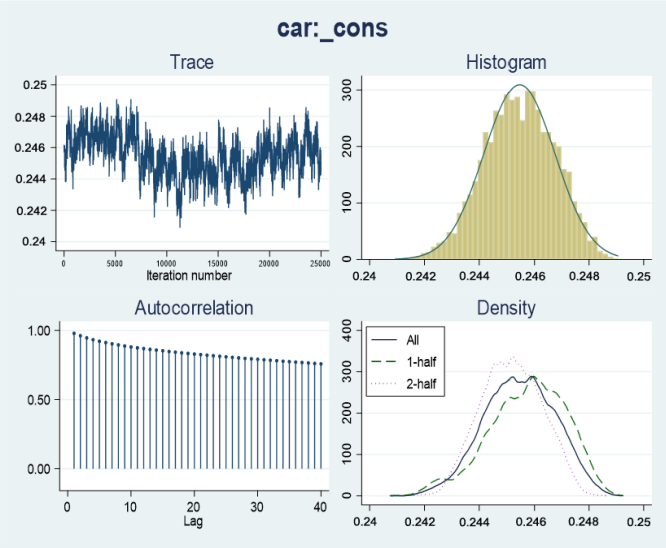


Figure 1. Posterior diagnostic plot for explanatory variables.

5. DISCUSSION

According to the findings of the regression analysis, the lagged CAR (CAR L1) variable (which has a coefficient of 0.115289) has a positive impact on the present CAR of Vietnamese commercial banks throughout the time of the research. This observation is consistent with the findings that Ünvan (2020) obtained. A regression coefficient of -0.42731 demonstrates that PRO has a substantial and negative influence on CAR. On the other hand, the PRO has a negative effect on CAR. This shows that banks with greater profitability often allocate profits to investments with the goal of extending their capital base. This may limit the capacity of these banks to achieve the capital criteria that have been established by the SBV. The results of Shingjergji and Hyseni (2015) are in agreement with this observation. However, the findings of Abiodun et al. (2020); Mekonnen (2015) and Ünvan (2020) are in contradiction to this discovery. The investigation also sheds light on the fact that there is a negative relationship between SIZE and CAR which suggests that bigger banks often have lower CAR. The fact that they have greater access to financial markets and cheaper transaction costs is likely to be the reason for this. These results align with previous research by Alyousef and Hewaidi (2018); Ünvan (2020) and Usman et al. (2019). Similarly, the liquidity ratio (LIQ) is found to correlate negatively with CAR which is consistent with Mekonnen (2015) but in contrast to the findings of Ahmad and Albaity (2019) and Ünvan (2020). Thus, this study does not support the perspective of Angbazo (1997) who suggested that banks with high liquidity ratios tend to exhibit higher CARs and lower liquidity fees. Finally, the deposit ratio (DEP) has a positive and statistically significant impact on CAR at the 5% level. Specifically, when DEP increases by 1 unit, CAR increases by 0.003879 units. This suggests that a higher deposit ratio improves the capital adequacy ratio in Vietnamese commercial banks. This result is consistent with the study of Mekonnen (2015). The variables LOA and LEV have a negative and statistically significant impact on CAR at the 1% level. This suggests that increasing debt financing leads to a decrease in CAR as banks with higher debt levels prioritize interest payments and maintain lower cash reserves to meet short-term obligations. These results are consistent with the study of Ünvan (2020) but are in contrast to the study of Kalifa and Bektaş (2018). Loan loss reserve (LLR) has a positive and statistically significant impact on CAR at the 1% level. This result is supported by El-Ansary and Hafez (2015a). On the contrary, the regression coefficient corresponding to NPL is -0.04449 indicating a negative and statistically significant impact on CAR. An increase in NPL reduces CAR, a result consistent with the study of Shingjergji and Hyseni (2015). In addition, macroeconomic factors such as GDP and CPI have positive and negative impacts on CAR at the 1% level of significance, respectively. This result is supported by the studies of Abiodun et al. (2020) and McClelland (1985).

BOARDS, FEMALEB and EDUB have a positive impact on CAR at the 1% level of significance regarding corporate governance variables. In contrast, INDEPB and FOREIGNB show a negative relationship with CAR but are not statistically significant. The positive impact of BOARDS on CAR suggests that a larger board size can improve bank oversight and strategic direction. An increase in board size is often accompanied by an increase in the level of expertise and experience, thereby improving risk management capabilities in areas such as credit, liquidity and investment management of commercial banks. In the context of Vietnam, where corporate governance standards and legal requirements from the State Bank of Vietnam (SBV) are increasingly tightened, a reasonably sized board can help banks enhance their compliance capabilities and manage capital more effectively. In addition, the positive impact of FEMALEB on CAR is also consistent with previous studies. Increasing the proportion of female board members can improve the quality of decision-making through more careful risk assessment, thereby improving the ability to control and manage capital. Current banking practices in Vietnam show that the proportion of women on the board of directors is still low, but increasing the presence of women not only contributes to improving governance capacity but also demonstrates a commitment to corporate social responsibility to stakeholders. Besides, EDUB has a positive impact on CAR showing that the high level of education of board members plays an important role in improving the quality of bank supervision and management. Board members with high education in finance, economics or law can more accurately assess fluctuations in the business environment. This is especially important as Vietnam increasingly integrates deeply into the international financial market, requiring banks to comply with global standards such as Basel II and III. Therefore, improving the quality of human resources on the board of directors can be an important strategy to enhance stability and resilience to financial risks.

Commercial banks need to determine the number of board members appropriate to the scale of operations to increase the capacity to orient, inspect and supervise banking operations and improve the CAR ratio according to international practices based on recommendations to increase the number of independent members, female leaders and management levels based on the results of the impact of corporate governance on CAR. Regulations in banking operations are increasingly strict and moving towards international standards, banking operations is increasingly applying modern technologies, thus requiring the qualifications of bank staff to be increasingly improved. Therefore, commercial banks need to have a plan to train and develop human resources in accordance with the requirements of bank innovation, especially female staff. Commercial banks need to consider using the criteria of a high educational level combined with experience as criteria for selecting personnel to become members of the board of directors. In addition, members of the board of directors themselves need to clearly understand their role in banking operations to continuously improve and upgrade themselves, including issues of educational qualifications and awareness related to banking operations. At the same time, banks regularly guide and organize training and knowledge development, mainly in training programs on knowledge, management skills, and working skills for leaders at all levels and staff in the entire banking system to gradually improve the quality of human resources according to international standards. The results of the study help provide more information for the orientation and planning of future reforms in Vietnamese commercial banks. Policymakers should carefully consider aspects of governance, paying more attention to the role and number of independent members to improve operational efficiency and increase competitiveness among banks as well as with foreign banks, thereby promoting greater contributions of the commercial banking system to economic growth for the restructuring to be successful, smooth and effective.

6. CONCLUSION

This study provides a comprehensive assessment of capital adequacy assurance among Vietnamese commercial banks from 2012 to 2023 with a particular focus on CAR. The research highlights the multifaceted nature of capital adequacy in the context of a rapidly developing financial market by examining both internal bank factors and macroeconomic variables. The use of Bayesian regression analysis, in conjunction with the traditional SGMM

estimation model adds methodological rigour by mitigating the shortcomings associated with conventional econometric techniques and offering probabilistic insights for more robust inferences.

The empirical findings underscore factors such as the previous period's CAR, deposit ratio, loan loss reserves, economic growth, board size, the proportion of female board members, and the educational qualifications of board members play a significantly positive role in enhancing the CAR of Vietnamese commercial banks. In contrast, the CAR exhibits an inverse and statistically significant relationship with bank profitability, size, leverage ratio, non-performing loans (NPL), and CPI. Although the study identifies a negative impact of the ratio of independent board members and the proportion of foreign members on the board, these effects do not reach statistical significance.

From a policy perspective, these results reinforce the importance of prudent governance structures, effective risk management, and a commitment to meeting international capital standards such as Basel II and III. The findings specifically emphasize the added benefits of fostering board diversity particularly in terms of gender and educational background which can lead to enhanced oversight, stronger strategic decision-making, and ultimately, better capital buffers. In the broader context of Vietnam's evolving banking sector, these governance-focused insights can serve as a scientific foundation for formulating policies aimed at safeguarding financial stability and boosting the global competitiveness of domestic banks.

This study acknowledges certain limitations, including its concentration on Vietnamese joint stock commercial banks and the use of specific proxies for corporate governance variables despite its contributions. Future research can address these gaps by expanding the scope to other types of financial institutions, incorporating more nuanced governance indicators and applying advanced econometric methods tailored to the complexities of emerging economies. Such efforts will enrich our understanding of how various dimensions of governance interact with capital adequacy, ultimately guiding more effective regulatory and strategic decisions in Vietnam and beyond.

Funding: This research is supported by the Ho Chi Minh University of Banking.
Institutional Review Board Statement: Not applicable.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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