


Examining the Impact of Capital Adequacy on Bank's Profitability in Sierra Leone

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Abstract: *The recent global pandemic and geopolitical tensions have sparked a renewed focus on financial systems stability, prompting central banks worldwide to take proactive steps to shield their populations from potential external disruptions. Among the initiatives undertaken by the Bank of Sierra Leone is a phased increase in the minimum paid up capital of domiciled banks, initially set at 85 million new Leones (approximately 5.5 million USD) to be implemented over three years. Current evidence indicates that banks' average Return on Assets (ROA) is 2.97%, with some banks facing losses. The Capital Adequacy Ratio (CAR) has an average of 59.29%, suggesting generally strong capital positions, though there is considerable variability. This study thus examines whether capital adequacy significantly affects the profitability of domiciled banks in Sierra Leone. Using data spanning 2009Q1-2022Q4, the result shows that a 1% increase in capital adequacy leads to a 0.307% increase in ROA. However, excess capital reserve negatively affects bank profit. Furthermore, 1% increase in total asset (proxy for bank size) increases banks' profitability by 0.017%. Conversely, the presence of non-performing loans (NPLs) had a detrimental effect on profitability, as elevated NPL levels heightens credit risk and necessitates high provisions for bad loans. As a result, this study emphasizes the need for a prudent implementation of the new capital requirement as over-capitalization could reduce profitability and dividend payouts to shareholders. The relatively high non-performing loans poses a risk of diminishing banks' profits and asset quality, especially during periods of financial crisis.*

Keywords: *Return on Assets; Capital Adequacy; Banks; Fixed Effects; Random Effects.*

Introduction

The global pandemic and the Russia-Ukraine conflict have renewed interest in financial system stability and highlighted the critical role played by a robust banking sector in insulating a nation's financial and economic systems. Banks' ability to facilitate credit for productive ventures not only drives economic growth but also ensures long-term economic sustainability (Dell'Ariccia & Marquez, 2006). For banks to play their intermediation role successfully, they must maintain substantial capital reserves to absorb potential losses during economic and financial uncertainties (Ezike & Oke, 2013). Consequently, ensuring the resilience and stability of the banking system is a core responsibility of many central banks worldwide, including the Bank of Sierra Leone (BSL) as mandated by the BSL Act of 2019.

Sierra Leone's banking sector since the end of the civil conflict in 2002 has undergone notable transformation through liberalization and regulatory reforms, fostering enhanced financial intermediation and concentration. Capital adequacy, initially introduced by the Basel Committee in 1988, plays a critical role in the global banking landscape. These regulations (Basel I, II, and III) mandate globally active banks to maintain a minimum capital requirement of 8 percent of risk-adjusted assets, comprising Tier I and Tier II capital components. In 2018, the BSL introduced new regulations, necessitating banks to maintain higher capital reserves of 85 million new Leones, and revised prudential guidelines, with a focus on risk-based banking supervision. While some banks diversified revenue sources to bolster profitability, adherence to prudential guidelines aimed to enhance risk management, corporate governance, anti-money laundering/counter-financing of terrorism measures, and loan loss provisioning was dawdling. As at December 2021, only 64 percent of the industry's fourteen (14) commercial banks fulfilled the new statutory minimum paid-up capital requirement.

Despite maintaining high capital adequacy, banks earned moderate profitability, with some incurring losses. Figure 1 shows the trend in capital adequacy and profitability of domiciled banks in Sierra Leone. This reveals that excessive capital adequacy may not necessarily translate into higher profitability of commercial banks. Ultimately, achieving a balance between capital adequacy and profitability is crucial for ensuring the long-term stability of Sierra Leone's banking system. Available empirical evidence shows that the relationship between capital adequacy and profitability of the banking sector remains complex and multifaceted. Aburime *et al.* (2009); and Satyamurthy *et al.* (2007) suggest that well-capitalized banks tend to have higher profitability due to reduced credit risk and better ability to absorb losses. However, other studies have suggested that this relationship may not always hold, as banks may prioritize short-term profitability over long-term capital adequacy. More so, Akpan *et al.* (2018) found that in Nigeria, there is an inverted U-shaped relationship between capital adequacy and profitability, implying that banks that are too well-capitalized may actually be less profitable. Another study by Sengupta (2017) found that the relationship between capital adequacy and profitability in India is contingent on the level of competition in the banking sector. Additionally, regulatory compliance costs and competition from informal financial institutions can also affect profitability (Oyewole *et al.*, 2020).

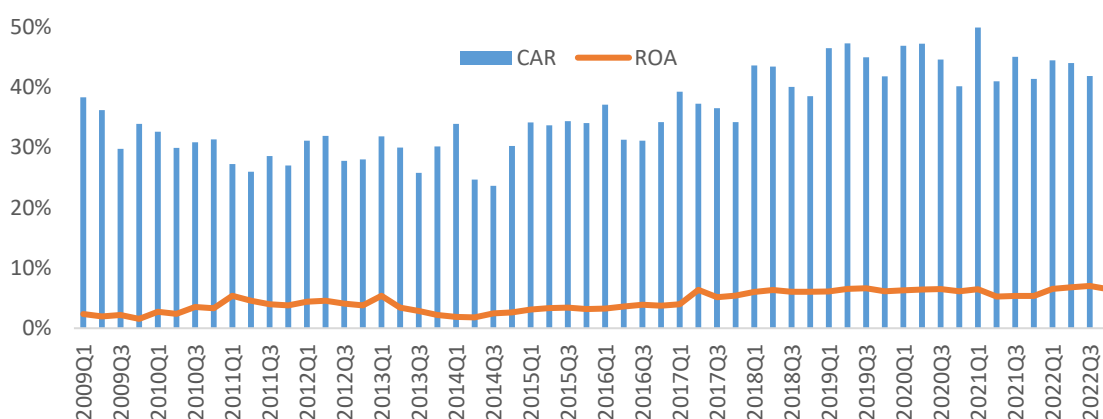


Fig. 1. Capital adequacy and return on assets of domiciled banks in Sierra Leone

Source: Author's computation from BSL data (2023).

Prior studies by Daboh & Duramany-Lakkoh (2023) and Kaitibi *et al.* (2017) have not explored the connection between capital adequacy and bank profitability in Sierra Leone. This study is thus different from past studies in so many ways. Firstly, it uses extensive micro level data from the banking sector spanning 2009Q1 to 2022Q4. Secondly, this study uses panel data regression, unlike other studies that utilized qualitative analysis or at best ordinary least squares. Wooldridge (2010) states that this approach allows for better capturing of dynamics, reducing

omitted variable bias, and improving statistical power. Panel data regression offers advantages over ordinary least squares (OLS) by utilizing data from multiple observations over time and across entities, which enhances efficiency and control for individual heterogeneity and time-related effects. Finally, by incorporating bank size and credit risk as factors, the panel data model considers bank's specific characteristics, thereby reducing endogeneity problem. The empirical outcomes highlight significant connections between capital, size, and credit risk with bank's profitability, aligning with apriori expectations. Remarkably, despite dynamic changes in the Sierra Leonean banking landscape, including shifts in industry concentration and the entry of new banks, excess capital does not significantly influence banks' profitability.

The paper is organized in the following manner. Section 2 discusses the existing literature on bank capital adequacy and profitability. Section 3 describes the model specification and data sources. Section 4 presents the empirical results and analysis. Section 5 concludes the paper.

Literature Review

Diamond and Ragan (1999)'s Bank capital theory formed the premise of this paper. The theory examines the role of bank capital in the stability and functioning of the banking sector. It argues that bank capital serves as a financial cushion or buffer that absorbs losses when a bank's assets, such as loans and investments, decline in value. This cushion provides a critical layer of protection for depositors and other stakeholders like central Banks. The theory highlights trade-off between risk and reward faced by banks. Banks can increase their profitability by taking on more risk, such as making riskier loans or investments. However, this exposes the bank to greater insolvency risk, which can threaten depositors and the stability of the financial system. As a result, banks need to maintain a balance between profitability and capital reserves by holding only adequate capital, while also generating profits to sustain their operations and reward their shareholders.

Different studies have demonstrated mixed and complex relationship between capital adequacy and profitability of the banking sector. Pioneering research by Berger *et al.* (1995) and Athanasoglou *et al.* (2008) indicate that well-capitalized banks tend to outperform undercapitalized ones. Aburime *et al.* (2009) and Satyamurthy *et al.* (2007) revealed that well-capitalized banks tend to have higher profitability due to reduced credit risk and better ability to absorb losses. Furthermore, Athanasoglou *et al.* (2008) shows that well capitalized larger banks tend to exhibit higher profitability levels due to economies of scale, better diversification, and increased market power. Agoraki *et al.* (2011) found a U-shaped relationship between bank size and profitability, indicating that moderate-sized banks tend to be more profitable compared to both very large and very small banks. Yucel (2014) and Berger & DeYoung (2001) also find that larger banks tend to have higher risk-adjusted returns compared to smaller banks. They attribute this to larger banks' ability to achieve cost efficiencies and diversify their loan portfolios, maintain strong corporate governance, stable political environment and low levels of non-performing loans.

Jalloh (2017) found that bigger capitalized banks had more profitability in Nigeria, and thus the bank consolidation enabled Nigerian banks to expand to other countries. Meanwhile, Olalekan and Adeyinka (2013) found a non-significant relationship between capital adequacy and a bank's profitability. This departure from the expected trend sparks intrigue and beckons further exploration. However, amidst these challenges, studies such as Fosu *et al.* (2017) have illuminated a promising facet. Employing advanced panel data analysis techniques, the study revealed positive relationship between the capital adequacy ratio (CAR) and return on assets (ROA).

In Sierra Leone, studies on the banking sector have mainly focused on credit risk management due to high non-performing loans. For instance, Jackson and Tamuke (2022) assessed the nexus

between credit risks and commercial bank performance in Sierra Leone. Their research spanned the period from 2008Q1 to 2018Q4. The evidence derived from panel data estimation within the fixed effects model highlighted the fragility of the banking system due to high non-performing loans (NPLs). Using Rokel commercial bank as a case study, Kaitibi *et al.* (2018) assesses how effective credit management impacts the profitability of commercial banks in Sierra Leone. They analyzed the data using both quantitative and qualitative methods, involving ratio analysis and charts. The outcomes highlighted a significant connection between the profitability of commercial banks and the efficiency of credit management.

Osei-Assibey & Bockarie (2013) explores the factors that influence the provision of loans by banks. They used data from an unbalanced panel of 13 commercial banks over a ten-year period (2002 to 2011). The results of the study revealed that the risk premium, the proportion of non-performing loans in the banks' loan portfolio, the tier 1 capital ratio (leverage ratio), and the levels of local currency deposits have positive influence on loan provision. Conversely, the ratio of advances to local currency deposits and the size of the bank has negative effects on the proportion of loans in banks' assets. Daboh and Duramany-Lakkoh (2023) evaluated the performance of Sierra Leone's banking sector using the Camel rating framework by employing the Least Squares regression method and considered data from 2012 to 2021. The study revealed positive and significant impact of capital adequacy and earnings capacity on the performance of banks.

Despite several studies exploring various aspects of banking performance and risk management in Sierra Leone, there remains a gap in understanding the specific relationship between capital adequacy and the profitability of banks. This study aims to address this gap by examining the impact of capital reserves, a key component of Financial Systems Indicators (FSIs), on the profitability of domiciled banks in Sierra Leone, contributing valuable insights to both the academic literature and the practical decision-making of bank regulators.

Data and Methodology

Formulation of Model

Bank's profitability is defined as ratio of profit after tax to total assets; it is the ability of banks to generate profits from their operations and indicates how much profit a bank earns relative to its assets or shareholders' equity. Return on Assets (ROA) is a superior measure because it is not influenced by variations in capital structure or leverage, making it easier to assess a bank's performance relative to its peers. The empirical model of the study adapted the works of Jalloh (2017), Kargi (2011), and Funso, Kolade, & Ojo (2012) to determine the effect of capital reserves on the profitability of domiciled banks in Sierra Leone. The model is specified as in equation (1) below:

$$ROA_{it} = B_0 + B_1 CAR_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

To incorporate bank specific characteristics such as excess capital, bank size and credit risk management, we expand equation (1) to equation (2) as below.

$$ROA_{it} = B_0 + B_1 CAR_{it} + B_2 CAR^2_{it} + B_3 TA_{it} + B_4 CR_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Taking natural logarithms of all variables on both sides, equation (2) is rewritten as below.

$$\ln ROA_{it} = B_0 + \ln B_1 CAR_{it} + B_2 CAR^2_{it} + \ln B_3 TA_{it} + \ln B_4 CR_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

Where ROA denotes return on assets; CAR denotes capital adequacy ratio; CAR^2 means square root of CAR; TA denotes total assets and CR denotes credit risk. $B_0 - B_4$ are the coefficients, μ_i denotes individual effect and ε_{it} denotes error term. All variables except CAR^2 and CR are

expected to have positive signs. In addition, if B_2 is statistically significant, it means that excess capital greatly impacts bank's profitability.

Given the specificity of the data and model specifications, pooled ordinary least squares, fixed effect model and random effect model are estimated accordingly.

The other variables are defined as follows:

1. *CAR (Capital Adequacy Ratio)*, measures regulatory capital to risk-weighted assets. Because well-capitalized banks are assumed to take less risk, we use the equity ratio to total assets to control capital risk. It is proxy to assess the effectiveness of macro-prudential policies on the financial stability by reducing the likelihood and severity of financial crises.
2. *CAR²* is excess capital reserves in banks and can have positive or adverse consequences on their financial performance and overall competitiveness. This situation could often lead to higher or lower returns as the surplus capital results in resources allocation dilemma. Although excess capital incurs a cost, it often insulates banks from potential losses in financial turmoil periods.
3. *TA (Total Assets)* measures bank size. The logarithm of total assets is used to account for the potential size effect on bank profitability, as the too-big- to-fail can destabilize the efficient financial intermediation of the entire banking system.
4. *Non-performing loan/loans*: We also use the ratio of non-performing loans as a proxy for credit risk of banks. This is a traditional ex-post measure of bank credit risk and is defined as the ratio of defaulting loans (payments of interest and principal past due date by 90 days or more) to total gross loans.

Diagnostic Tests

Prior to the estimations, three diagnostic tests reinforce the analytical approach. Firstly, the Breusch-Pagan LM test evaluates independence, discerning random effects from simple OLS regression. Subsequently, the Hausman-test examines the suitability between fixed effects and random effects models. Lastly, the multicollinearity test gauges significant multicollinearity presence, with VIF values beyond 5 or 10 indicating notable multicollinearity (Greene, 2008).

Data and Sources

The study spans 2009Q1 to 2022Q4, drawing data from Annual Reports and Accounts of 13 commercial banks domiciled in Sierra Leone. This is the period with complete data for all study variables. One bank is omitted due to incomplete data. These banks conform to the Banking Act of Sierra Leone and have continuously operated over 14 years.

Analysis and Findings

The Descriptive Statistics and model Estimation results are presented and discussed in this section. Table 1 provides summary statistics on capital adequacy and profitability of domiciled banks in Sierra Leone. The average Return on Assets (ROA) is 2.97%, indicating moderate profitability, with some banks facing losses. The Capital Adequacy Ratio (CAR) has an average of 59.29%, suggesting generally strong capital positions, though there is considerable variability and some banks even fall below the minimum CAR threshold of 15%. However, NPL stands at 16.95% on average, exceeding the standard prudential threshold of 10%, indicating credit quality issues. Total Assets (TA) have an average of 533 million, highlighting the significant size of the banking sector. To maintain a stable banking system, addressing high NPL levels and ensuring adequate capitalization in some banks should be prioritized.

Table 1. Descriptive Statistics of the Banking Sector in Sierra Leone

Variable	Obs	Mean	Std. dev.	Min	Max
ROA	728	2.974725	4.541453	-49.19	33.93
CAR	728	59.28792	56.08213	-69.89227	744.9037
TA	728	5.33e+08	5.71e+08	1.94e+07	4.10e+09
NPL	728	16.94567	23.19541	-43.97	416.51

Source: Author's computation (2023).

Before estimating the panel regression, multi-collinearity is tested. The results from Table 2 show that the variables CAR, TA and NPL have VIF values below 2, indicating no significant multicollinearity among them. The mean VIF of 1.25 confirms that the variables are not highly correlated with each other. Table 3 also supports this assertion by showing no high correlation, weak to moderate correlations are observed between some pairs, suggesting potential relationships that are not strong enough to imply a significant linear dependency between the variables.

Table 2. Testing the Multi-collinearity

Variable	Collinearity statistics	
	VIF	1/VIF
LCAR	1.38	0.722340
LTA	1.20	0.835755
LNPL	1.17	0.851494
Mean VIF	1.25	

Source: Author's computation (2023).

Table 3. Testing Correlation

	LROA	LCAR	LTA	LNPL
LROA	1.0000			
LCAR	0.0331	1.0000		
LTA	0.2522	0.3923	1.0000	
LNPL	-0.1650	-0.3715	0.0514	1.0000

Source: Author's computation (2023).

In a bid to assess the robustness of the models, we went further by conducting post-estimation tests. The Hausman test presented in Table 4 indicates a very low p-value (=0.001) and shows that fixed effects model is more suitable over random effects as it addresses endogeneity concerns. Furthermore, Table 5 shows the Breusch and Pagan Lagrangian multiplier test, indicating no significant differences in random effects among individual entities in the panel data. This supports the use of a fixed effects model, and reveals that individual heterogeneity does not play a significant role in explaining the variation in the dependent variable (ROA) across different entities.

Table 4. Hausman Test

	Coefficient			sqrt(diag(V _b -V _B)) Std. err.
	(b) fixed	(B) random	(b-B) Difference	
LCAR	0.106807	0.074579	0.032228	0.0089506
LTA	0.016934	0.0361	-0.01917	0.00547
LNPL	-0.06538	-0.06583	0.000451	0.002503

b = Consistent under H₀ and H_a; obtained from xtreg.
B = Inconsistent under H_a, efficient under H₀; obtained from xtreg.
Test of H₀: Difference in coefficients not systematic
chi2(3) = (b-B)'[(V_b-V_B)⁻¹](b-B) = 6.3
Prob > chi2 = 0.0014

Source: Author's computation (2023).

Table 5. Breusch and Pagan Lagrangian multiplier test for random effects

lroa _{it} =X _{it} β +u _{it} +e _{it}			
Estimates results:			
		VAR	SD=sqrt(Var)
	LROA	0.111552	0.3339946
	e	0.086382	0.2939081
	u	0.013892	0.1178623
Test : Var (u) = 0			
	chibar2(01) =	217.05	
	Prob>chibar2 =	0.0000	

Source: Author's computation (2023).

Table 6 shows the output of pooled panel regression, fixed effects model and random effects model, with fixed effect model being deemed the most appropriate based on the Hausman test. The outcome of the fixed effects model corroborates the apriori expectations, except that excessive cash CAR², is statistically significant. The result shows that a 1% increase in Capital adequacy will lead to an increase of ROA by 0.307%, indicating a strong positive relationship between capital adequacy and profitability. However, excessive capital does have significant negative impacts on profit of banks. The finding aligns with previous research which states that capital adequacy ratios are generally associated with better profitability and stability in the banking sector (Jalloh, 2017; Louzis *et al.*, 2013; Satyamurthy *et al.*, 2007). The result implies that excess cash significantly reduces profitability of domiciled banks. This is probably because over-capitalization tends to be more important in periods of financial downturns to absorb losses, which contributes to their long-term profitability (Berger & Bouwman, 2013; De Jonghe, 2010).

Another key determinant bank specific determinant for profitability is bank size. The result indicates that a 1% increase in total asset (proxy for bank size) could improve bank profitability by 0.017%. Similar to capital adequacy, total assets also have a positive and statistically significant relationship with profitability. An increase in total assets is linked to a rise in profitability. The finding supports results by Bayar, Gündüz, & Sezgin (2019) and Yucel, E. (2014). The study also revealed that larger banks, particularly those with higher market shares, tend to take on more risk in their operations. This could be attributed to the benefits of diversification and economies of scale that large banks enjoy. However, the relationship between bank size and profitability is complex, as larger banks may enjoy cost advantages but also face higher agency costs (Degryse & Ongena, 2005).

Furthermore, the result also shows that a 1% increase in non-performing loan reduces ROA by 0.066%, suggesting a strong negative relationship between non-performing loans and profitability. As the level of non-performing loans increases, profitability tends to decrease. Banks with lower levels of non-performing loans tend to have higher profitability due to reduced credit risk and provisions for bad loans (e.g., Athanasoglou *et al.*, 2008). The elevated non-performing loans poses a risk of diminishing banks' profits and asset strength, especially during periods of economic shocks (Hidayat *et al.*, 2022). Additionally, this situation casts doubt on the feasibility of dividend payouts to shareholders due to the banking system's fragility in maintaining a consistently liquid state to meet customer demands (Jackson & Tamuke, 2022).

Finally, the F-test statistic (11.06) measures the overall significance of the regression model. The associated probability (Prob > chi2) is 0.0000 indicates that the model is highly significant overall. The Adjusted R-squared value (0.4108) indicates that the model explains approximately 41.08% of the variance in profitability and it is statistically significant (the model's explanatory power is relatively good). Thus, this result suggests that there might be other factors not included in the model that influence profitability such as market discipline, regulatory quality, competition, banking supervision, IT infrastructure, payment systems or management quality.

Table 6. Panel Regression Estimations Output

Variables	Pooled OLS	Fixed Effects	Random Effects
InCAR	0.002*** (0.202)	0.307*** (0.024)	0.0746** (0.022)
InCAR ²	-0.079* (0.148)	-0.017*** (0.022)	-0.036*** (0.019)
InTA	0.155 (0.012)	0.299 (0.015)	0.188 (0.014)
InNPL	-0.067*** (0.015)	-0.066*** (0.015)	-0.065*** (0.015)
Constant	0.802* (0.280)	1.613** (0.298)	1.363* (0.292)
Observations	701	701	701
Adj. R-Squared	0.1354	0.4108	0.2969
Bank effect	YES	YES	YES
Period effect	NO	NO	NO
Rmse	0.31835		
F-test	24.5	17.96	
Prob>F	0.0000	0.0000	
No. of crossid		13	13
F-test(u _i =0)		11.06	
Prob>F(u _i =0)		0	
Wald chi2			47.53
Prob > chi2			0.0000

Standard errors in parenthesis;

***p<0.01

Source: Author's computation (2023).

Conclusion

Banks play a vital function in mobilizing savings and channeling them into productive investments, thereby stimulating economic growth and development. The performance of banks has significant implications for economic growth, as sound financial performance rewards stakeholders and encourages further investments, while poor banking performance can lead to banks' failure, potentially hampering the overall economic growth of the country. Adequate capitalization is essential for efficient bank operations and long-term profitability. Available empirical evidence shows that the relationship between capital adequacy and profitability of the banking sector remains complex and multifaceted. This study specifically focuses on the impact of capital reserves on the profitability of domiciled banks in Sierra Leone. The results indicate that there is a strong positive relationship between capital adequacy and profitability. But excess capital adequacy ratios are not associated with better profitability in the banking sector, as excess cash holdings reduce bank's short-term profitability due to missed income opportunities.

Additionally, the study finds that bank size (measured by total assets) also positively affects profitability. Larger banks, particularly those with higher market shares, tend to enjoy benefits of diversification and economies of scale, contributing to improved profitability. Conversely, the study identifies non-performing loans (NPLs) as a significant factor negatively impacting profitability. As the level of NPLs increases, profitability tends to decrease. Banks with lower levels of NPLs have higher profitability due to reduced credit risk and provisions for bad loans. Overall, the regression model is statistically significant, explaining approximately 41.08% of the variance in profitability. While the model provides valuable insights, there may be other factors

not included in the analysis that influence profitability, such as competition, banking supervision, IT infrastructure, payment systems, or management quality. Overall, the results are consistent with existing studies on capital adequacy and profitability in the banking industry, supporting the idea that maintaining strong capital adequacy ratios and managing non-performing loans are essential for enhancing profitability.

In light of these findings, policymakers and regulatory authorities in Sierra Leone should focus on ensuring that banks maintain adequate but not excessive capital levels to support their operations, particularly in period of relative economic stability. Additionally, efforts to reduce non-performing loans and promote healthy loan portfolios are essential to enhance overall banking sector stability and profitability. Furthermore, continuous monitoring and evaluation of the banking system's performance are crucial to address emerging challenges and foster sustainable economic growth in the country. Therefore, further research may be needed to explore other determinants of profitability in the banking sector.

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