# Financial Sustainability : The Influence of Internal Efficiency in Indian Commercial Banks

*Smitisikha Guru* [1]
*Priyabrata Panda* [2]

## Abstract

**Purpose : The paper examined the relationship between internal bank efficiency and financial sustainability within the specific context of Indian commercial banks. The study aimed to provide empirical evidence on the determinants and consequences of internal bank efficiency and its impact on the long-term financial sustainability of Indian commercial banks.**

**Methodology : The panel data consisted of 65 banks for a sample period of 10 years from 2012 to 2021 and was analyzed using panel regression and generalized methods of moments models to analyze the interplay between CAMEL parameters and profitability and stability.**

**Findings : The findings of the study offered valuable insights into drivers of internal efficiency in Indian commercial banks, such as capital sufficiency, asset quality, operational efficiency, cost management, liquidity, and earning efficiency.**

**Practical Implications : The results underscored the significance of augmenting internal efficiency as a means of propelling enduring financial performance, irrespective of the sizes and varieties of banks.**

**Originality : In contrast to earlier studies, the present study highlighted the immediate and long-term effects of internal efficiency variables on the stability and profitability of banks.**

***Keywords :*** **financial sustainability, bank efficiency, performance, profitability, bank stability**

**JEL Classifications Codes : C23, G21, G28, L25, O16**

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The COVID-19 pandemic, for example, had a major influence on financial systems around the world, and other recent occurrences have presented hitherto unheard-of problems to the global financial environment (Budhedeo & Pandya, 2018). It becomes essential in this situation to make sure financial institutions are sustainable. Since bank efficiency directly impacts a bank's capacity to resist economic shocks, deliver returns to shareholders, and support financial stability, it is essential to this goal. Considering the current economic conditions, the emphasis on sustainability, and the unique characteristics of the Indian banking sector, it is crucial to determine the factors affecting bank efficiency to devise strategies that foster financial sustainability. This research addresses the relationship between bank efficiency and financial sustainability, aiming to conduct an empirical study within the Indian banking industry. The study seeks to explore the determinants and consequences of a bank's internal efficiency, considering factors such as operational efficiency, resource management, risk management practices, and capital adequacy.

[1] *Research Scholar,* Gangadhar Meher University, Amruta Vihar, Sambalpur - 768 004, Odisha.
(Email : smitisikha.guru@gmail.com) ; ORCID iD: https://orcid.org/0000-0002-2722-9329
[2] *Assistant Professor,* Gangadhar Meher University, Amruta Vihar, Sambalpur - 768 004, Odisha.
(Email : pandapriyabrata@rocketmail.com)

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Few studies have offered thorough insights into the relationship between bank efficiency and financial sustainability, despite the fact that current literature has examined many facets of both concepts, especially in the context of the Indian banking sector. Moreover, previous research has not thoroughly examined the impact of bank-specific characteristics, such as size, ownership structure, and asset quality, on internal efficiency and financial sustainability.

This research aims to fill this gap by employing rigorous econometric techniques and comprehensive efficiency measurement methodologies to identify the key drivers of internal bank efficiency and evaluate their impact on financial sustainability. The primary research question guiding this study is: How do the parameters of internal efficiency influence financial sustainability within the Indian banking sector? Do these impacts persist in the long term?

This research will increase the resilience, efficiency, and sustainability of Indian commercial banks, hence building a more resilient financial system, by identifying the factors that determine internal bank efficiency and its consequences for financial sustainability.

## Literature Review and Hypotheses Development

### *Financial Sustainability and its Parameters*

Financial sustainability in banks has gained significant attention in recent years as banks are facing increasing pressure to balance profitability with responsible and ethical practices. Financial sustainability, in general terms, may be defined as the ability to maintain a stable and viable financial position over the long term. It involves effectively managing financial resources, generating consistent profits, and mitigating risks to ensure sustenance and growth.

Global research on bank stability and profitability has been conducted using metrics like return on equity (ROE) and return on assets (ROA) to assess management and shareholder performance. Hersugondo et al. (2021) examined the role of asset quality, capital adequacy, and insolvency risk on bank performance, while Abbas et al. (2019) studied the impact of liquidity, capital, and credit risk on the profitability position of banks after the 2007–2008 global financial crisis, finding the intensive positive impact of liquidity on profitability across banks of all sizes. Similarly, Ali and Puah (2019) examined the internal determinants of stability and profitability, emphasizing the impact of bank size on profitability and stability. As a result, ROA and ROE are commonly employed as profitability metrics in numerous studies, including those conducted by Bansal et al. (2018) and Nataraja et al. (2018).

Nevertheless, achieving financial sustainability necessitates both profitability and stability in performance to ensure long-term market survival. In the literature, bank stability is often assessed using the *Z*-score, which is calculated through two distinct approaches. A literature review found a negative correlation between banks and stability, especially in markets with lower levels of competition, fewer opportunities for diversification, and a higher concentration of government-owned banks. The *Z*-score was calculated using ROA, capital ratio, and standard deviation of ROA (Adusei, 2015; Ali & Puah, 2019; Tabak et al., 2013). In such situations, stringent capital regulations play a significant role in strengthening the stability of the sector. Altman's *Z*-score, an additional measure of stability, predicts the likelihood of bankruptcy based on internal financial ratios, where higher scores represent greater stability (Saha, 2018). Altman et al. (2017) reaffirmed this measure as a broad indicator of stability. They employed various internal parameters and ratios to estimate the likelihood of bankruptcy.

The key factors affecting bank stability include the equity ratio, loan loss provisioning, market share (Tabak et al., 2013), income diversification (Köhler, 2015), as well as capital adequacy, asset quality, management efficiency, earnings efficiency, and liquidity (Konovalova & Caplinska, 2021).

### *Efficiency and its Relationship with Financial Sustainability*

The efficiency of banks is a multifaceted concept encompassing income efficiency, profitability, asset management, capital sufficiency, customer satisfaction, technological innovations, and risk management. Various methodologies have been employed to analyze bank efficiency. Banerjee (2018) and Kumar and Kar (2021) utilized DEA models to assess the technical efficiencies of Indian banks, while Mohd Noor et al. (2020) employed panel regression and DEA to explore determinants of efficiency, noted the impact of capitalization and liquidity management. Miah and Uddin (2017) examined stability and efficiency, finding larger banks to be less efficient due to diseconomies of scale. Al-Homaidi et al. (2020) studied profitability determinants, observing the negative effects of bank size on ROA and ROE. Saleh and Afifa (2020) have demonstrated that bank performance is also impacted by credit and liquidity issues. The CAMEL framework is widely used to evaluate the performance of banks. Common areas of study include capital adequacy, asset quality, earning capacity, and liquidity (Sahota & Dhiman, 2017; Singh & Milan, 2023). Lotto (2019) highlighted the significance of capital adequacy and liquidity in determining profitability and efficiency. Vieira et al. (2019) considered additional factors, such as financial leverage and corporate governance in assessing bank performance. In general, these research works offer valuable perspectives on the intricate factors that impact the effectiveness and prosperity of banks.

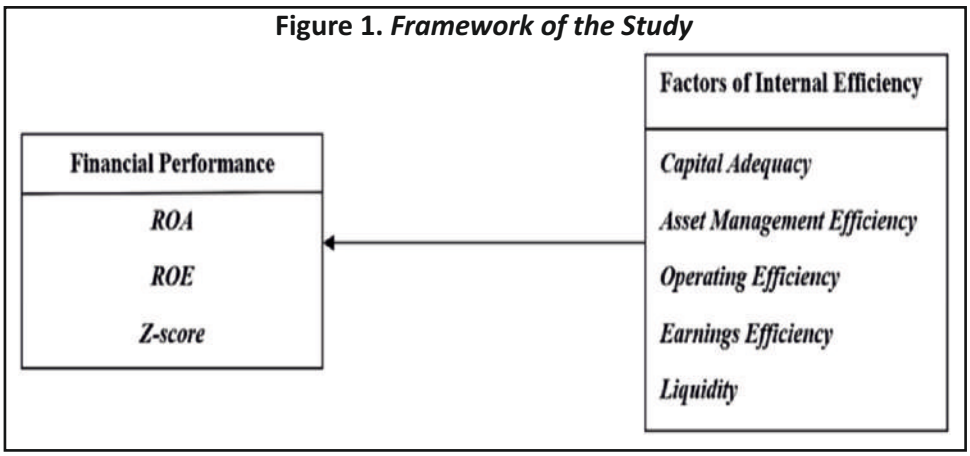
### *Financial Sustainability and Efficiency : In the Context of Indian Banks*

In the context of India, the literature has evidence of the impact of several internal and external factors influencing profitability. Ali and Dhiman (2019) demonstrated the influence of credit risk management on the profitability of public sector banks particularly noting their effect on ROA. Dhar and Bakshi (2015), Gaur and Mohapatra (2021), and Singh and Milan (2023) utilized CAMEL parameters to assess financial performance and asset quality, highlighting the negative impact of deteriorating asset quality on public sector banks' performance. An important finding is the negative correlation between business per employee and performance, which is attributed to the faster growth of advances compared to deposits. This has negatively impacted public sector banks, even though business per employee is typically viewed as a positive performance indicator. Dang (2019) and Gupta and Jaiswal (2020) suggested a balanced approach to advance expansion to maintain solvency and long-term profitability, emphasizing the importance of capital adequacy and asset quality management. Bansal et al. (2018) noted a reduction in private banks' profitability due to increased credit risk, contrasting with public sector banks. Budhedeo et al. (2020) emphasized the significance of liquidity in financial stress situations in the banking industry and found that Indian banks preferred higher liquidity in the post-crisis phase. Kaur (2019) addressed fraud and bankruptcy risks in Indian banks, measuring financial distress's impact on market performance. Almaqtari et al. (2019) found bank size, asset management, operational efficiency, and leverage significantly affected ROA and ROE positively for Indian commercial banks. These studies collectively underscored the complex interplay of factors shaping Indian banks' profitability and performance.

Based on the evidence in the literature, the parameters of the CAMEL framework provide a holistic structure to measure the overall internal efficiency of banks (refer to Figure 1). Thus, we hypothesize:

- **$H_{01}$ :** There is no significant relationship between the parameters of internal efficiency and the financial performance of Indian commercial banks.
- **$H_{02}$ :** There is no difference across the public sector, private sector, and foreign banks.
- **$H_{03}$ :** There is no difference across different bank sizes.

**Figure 1.** ***Framework of the Study***




## Data and Methodology

### *Data and Sample Construction*

The study follows an empirical research design. For the analysis, financial metrics such as profitability ratios, capital adequacy ratios, asset quality indicators, liquidity ratios, and other relevant variables have been used.

Data were extracted from the database of the Reserve Bank of India (2023) to maintain the reliability and authenticity of data. The frame for the study comprised the entire Indian banking industry, which included 12 public sector banks, 21 private sector banks, 12 small finance banks, 6 payments banks, 45 foreign banks, 34 state cooperative banks, 2 local banks, and 43 regional rural banks. The units of analysis were individual commercial banks within the Indian banking industry.

The present study has captured a sample of 65 banks consisting of 12 public sector banks, 18 private banks, and 35 foreign banks based on the availability of data in the studied time frame, ensuring representation from each category of banks. Table 1 provides the final sample distribution.

The post-2012–2013 fiscal year has been taken into consideration. This year marks the implementation of Basel III norms in the Indian banking sector that required higher capital requirements, enhancements in risk management and disclosure, and higher liquidity, which had implications on the performance of the banks and bank models. This resulted in the creation of a balanced panel data set with 650 bank year observations covering a sample period of 10 years, from 2012–2013 to 2021–2022.

### *Model Specification and Methodology*

The study applies both the panel regression model, generalized methods of moments (GMM) model, and ordinary

**Table 1.** ***Final Sample Distribution***

| Particulars | Public Sector Banks | Private Banks | Foreign Banks | Total |
|---|---|---|---|---|
| Total No. of Banks | 12 | 21 | 45 | 78 |
| No. of Sampled Banks | 12 | 18 | 35 | 65 |
| Sample % of the Total Banks Population | 100% | 86% | 77% | 83% |
| No. of Observations | 120 | 180 | 350 | 650 |

least square regression model using Stata 16 for the analysis. A generic specification of the regression models is specified in Equation (1).

$$y_{it} = \alpha + \beta_1 y_{it-1} + \beta_2 X_{it} + \gamma_t + \delta_i + \varepsilon_{it} \quad (1)$$

where,

$y_{it}$ is the performance indicator measured by the natural log of either ROA, ROE, or *Z*-score of bank *i* in year *t*. $y_{it-1}$ is the single-lagged auto-regressor of the dependent variable. $X_{it}$ represents a comprehensive set of independent variables that are used as a proxy of internal efficiency parameters of banks based on the CAMEL framework. As the model considers only internal factors of efficiency, $\gamma_t$ is a year dummy used to capture time-specific unobserved heterogeneity and related variable bias (Wooldridge, 2010). $\delta_i$ is a bank-specific dummy used to capture entity-specific fixed effects in the dataset.

The pre-defined model (Altman et al., 2017) has computed the *Z*-score for the given purpose:

$$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 \quad (2)$$

where,

$X_1$ = Working capital/ Total assets

$X_2$ = Retained earnings/ Total assets

$X_3$ = EBIT/ Total assets

$X_4$ = Book value of equity/ Total liabilities

In addition, pooled OLS regression is used to differentiate between the results based on bank types, i.e., public sector bank, private bank, and foreign bank, and also based on bank size.

$$y_{it} = \alpha + \beta_1 y_{it-1} + \beta_2 X_{it} + \beta_3 BankType_{it} + \gamma_t + \delta_i + \varepsilon_{it} \quad (3)$$

$$y_{it} = \alpha + \beta_1 y_{it-1} + \beta_2 X_{it} + \beta_3 BankSize_{it} + \gamma_t + \delta_i + \varepsilon_{it} \quad (4)$$

where, $BankType_{it}$ is a dummy for bank type included in Equation (2) to analyze the effect of the type of bank. Values have been assigned as 1 for public sector banks, 2 for private banks, and 3 for foreign banks. Similarly, $BankSize_{it}$ is a dummy for bank size included in Equation (3) to analyze the effect of bank size. It has been determined based on the median of the natural log of total assets of all banks. The median of total assets was found to be 10.5908. The dummy assumed the value 1 if the asset size was greater than 10.5908 and otherwise.

All the variables under study are in their natural logarithm form. Table 2 displays the measurements and definitions of every variable used in the models.

**Table 2.** ***List of Variables***

| Variable | Abbreviations | Definition | Expected sign | Source |
|---|---|---|---|---|
| **Dependent Variables** | | | | |
| Return on Assets | *ROA* | Natural log form of net income claimed by total assets. | | RBI Database |
| Return on Equity | *ROE* | Natural log form of net income claimed by total equity. | | RBI Database |
| Altman's *Z* | *Z*-score | Natural log form of individually calculated Altman's *Z*-score for bank stability. | | RBI Database and own calculations |
| **Independent Variables** | | | | |
| Capital Adequacy Ratio | *CAR* | The natural logarithm of the capital adequacy ratio is calculated as a ratio of total capital on the risk-weighted assets. | +/– | RBI Database |

| | | | | |
|---|---|---|---|---|
| Non-Performing Assets to Total Assets | *NPA* | Natural log form of the ratio of net non-performing assets to total assets. It is used to measure the asset quality. | – | RBI Database |
| Credit to Deposits Ratio | *CD* | Natural logarithm of the ratio of total credits to deposits. It is used to measure the credit generation and risk management efficiency of management. | +/– | RBI Database |
| Business Per Employee | *BPE* | Natural logarithm of business generated by each employee. It is used as a measure of resource management efficiency of management. | + | RBI Database |
| Profit per Employee | *PPE* | Natural logarithm of profit per employee. It is used as a measure of resource management efficiency of management. | + | RBI Database |
| Net Interest Margin | *NIM* | Natural logarithm of net interest margin. It is used as a measure of earning efficiency from core operations. | + | RBI Database |
| Non-interest Income to Total Assets | *NTA* | Natural logarithm of the percentage of non-interest income generated by total assets. It is used as a measure of earning efficiency from diversification. | +/– | RBI Database |
| Burden Ratio | *BR* | Natural logarithm of burden ratio. It measures the cost efficiency as a proportion of the bank's non-interest expenses to its net interest income. | – | RBI Database |
| Liquidity Ratio | *LC* | Natural logarithm of the ratio of liquid assets to total current liabilities. It measures liquidity risk management efficiency. | +/– | RBI Database and own calculations |
| Free Cash Flow to Demand Deposits | *FDD* | Natural logarithm of the ratio of free cash flow to total demand deposits of the bank. It measures liquidity risk management efficiency. | +/– | RBI Database and own calculations |
| Bank Type | *BankType* | The dummy variable is used to categorize 1 as public sector banks, 2 as private sector banks, and 3 as foreign banks. | | RBI Database and own calculations |
| Bank Size | *BankSize* | The dummy variable is used to categorize banks as large banks and small banks based on the median of total assets of all banks. 1 is assigned to large banks if total assets > median and 2 to small banks if total assets < median. | | RBI Database and own calculations |

### *Descriptive Statistics*

Table 3 presents the overall descriptive statistics. The *Z*-score, ROA, and ROE performance indicators have low minimum values. Throughout the research period, the banks' return on their resources was extremely erratic and occasionally even negative. There are variations depending on the type of bank: private banks have the greatest

**Table 3.** ***Overall Descriptive Statistics***

| Variable | Obs. | Mean | Std. Dev. | Min. | Max. | VIF | 1/VIF |
|---|---|---|---|---|---|---|---|
| *ROA* | 649 | –0.0593 | 1.106 | –4.6052 | 3.266 | | |
| *ROE* | 650 | 1.833 | 1.084 | –4.026 | 4.2124 | | |
| Altman's *Z* | 650 | 0.421 | 0.9695 | –1.123 | 8.366 | | |
| *CAR* | 649 | 3.08 | 0.712 | 2.135 | 6.4388 | 2.45 | 0.40 |
| *NPA* | 446 | 0.56 | 1.228 | –4.605 | 3.999 | 1.30 | 0.76 |
| *CD* | 637 | 4.388 | 0.83148 | –0.923 | 11.41 | 1.81 | 0.55 |
| *BPE* | 648 | 7.51 | 1.17 | –1.427 | 10.0174 | 2.14 | 0.46 |
| *PPE* | 649 | 2.839 | 1.516 | –2.8134 | 6.4614 | 1.59 | 0.62 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *NIM* | 650 | 1.057 | 0.4514 | –4.13 | 2.347 | 1.66 | 0.60 |
| *NTA* | 650 | 0.158 | 1.019 | –7.899 | 3.6605 | 1.51 | 0.67 |
| *BR* | 650 | 2.498 | 1.278 | –4.139 | 11.3287 | 1.30 | 0.77 |
| *LC* | 650 | 4.032 | 3.939 | –7.135 | 17.388 | 1.48 | 0.67 |
| *FDD* | 636 | 4.43 | 1.538 | 1.065 | 13.078 | 1.38 | 0.72 |
| *Mean VIF* | | | | | | 1.66 | |

**Table 4.** ***Descriptives Categorized by Bank Type***

| | Public Sector Banks | | | Private Banks | | | Foreign Banks | | |
|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Obs.** | **Mean** | **Std. Dev.** | **Obs.** | **Mean** | **Std. Dev.** | **Obs.** | **Mean** | **Std. Dev.** |
| *ROA* | 120 | –0.796 | 0.88405 | 180 | –0.112 | 0.89457 | 349 | 0.2211285 | 1.15446 |
| *ROE* | 120 | 2.03161 | 0.90642 | 180 | 2.28892 | 0.82406 | 350 | 1.531629 | 1.1611 |
| Altman's *Z* | 120 | –0.4961 | 0.15284 | 180 | –0.0549 | 0.27753 | 350 | 0.9808059 | 0.9901 |
| *CAR* | 120 | 2.5089 | 0.14174 | 180 | 2.71183 | 0.17846 | 349 | 3.47562 | 0.76313 |
| *NPA* | 120 | 1.41141 | 0.61584 | 177 | 0.23818 | 1.0385 | 149 | 0.2488032 | 1.46437 |
| *CD* | 120 | 4.21789 | 0.13101 | 180 | 4.354 | 0.17456 | 337 | 4.468508 | 1.12645 |
| *BPE* | 120 | 7.38163 | 0.20768 | 180 | 7.10742 | 0.33723 | 348 | 7.768627 | 1.52412 |
| *PPE* | 120 | 1.64871 | 0.82078 | 180 | 2.00569 | 0.92339 | 349 | 3.678214 | 1.43477 |
| *NIM* | 120 | 0.81073 | 0.14514 | 180 | 1.12147 | 0.21692 | 350 | 1.10946 | 0.56742 |
| *NTA* | 120 | –0.088 | 0.28222 | 180 | 0.23366 | 0.4066 | 350 | 0.2041416 | 1.33969 |
| *BR* | 120 | 2.10773 | 0.75326 | 180 | 2.07069 | 0.98944 | 350 | 2.851972 | 1.43918 |
| *LC* | 120 | 1.27983 | 2.73212 | 180 | 2.51717 | 2.82314 | 350 | 5.755057 | 3.93196 |
| *FDD* | 120 | 4.15448 | 0.99979 | 180 | 3.85052 | 0.88187 | 336 | 4.844367 | 1.82663 |

average ROE, while foreign banks have comparatively superior average ROA and Z-score. When compared to public sector banks, foreign banks also exhibit better efficiency metrics, such as capital adequacy and profitability metrics (Table 4). There was no discernible variation in the statistics when comparing banks according to size, with the exception of the performance and liquidity metrics. Despite having a higher ROE, larger banks appear to have less stability, ROA, and liquidity than smaller banks (Table 5).

**Table 5.** ***Descriptives Categorized by Bank Size***

| | Large Banks | | | Small Banks | | |
|---|---|---|---|---|---|---|
| **Variable** | **Obs.** | **Mean** | **Std. Dev.** | **Obs.** | **Mean** | **Std. Dev.** |
| *ROA* | 325 | –0.2653 | 0.977 | 324 | 0.14731 | 1.18848 |
| *ROE* | 325 | 2.15651 | 0.8642 | 325 | 1.51078 | 1.18378 |
| Altman's *Z* | 325 | –0.1038 | 0.41382 | 325 | 0.94646 | 1.07632 |
| *CAR* | 325 | 2.65798 | 0.1963 | 324 | 3.51341 | 0.78232 |
| *NPA* | 305 | 0.56767 | 1.1591 | 141 | 0.53518 | 1.37199 |
| *CD* | 325 | 4.29144 | 0.21979 | 312 | 4.4905 | 1.15898 |
| *BPE* | 325 | 7.51839 | 0.60554 | 323 | 7.50816 | 1.54351 |
| *PPE* | 325 | 2.37132 | 1.29588 | 324 | 3.30829 | 1.57715 |
| *NIM* | 325 | 1.00881 | 0.31678 | 325 | 1.10646 | 0.55059 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *NTA* | 325 | 0.14218 | 0.45326 | 325 | 0.17459 | 1.36959 |
| *BR* | 325 | 2.0571 | 0.95978 | 325 | 2.93934 | 1.4007 |
| *LC* | 325 | 1.57206 | 2.65068 | 325 | 6.49237 | 3.45213 |
| *FDD* | 325 | 3.89652 | 0.87026 | 311 | 4.99347 | 1.85484 |

**Table 6.** ***Paired Correlation***

| | *CAR* | *NPA* | *CD* | *BPE* | *PPE* | *NIM* | *NTA* | *BR* | *LC* | *FDD* |
|---|---|---|---|---|---|---|---|---|---|---|
| *CAR* | 1.00 | | | | | | | | | |
| *NPA* | 0.00 | 1.00 | | | | | | | | |
| *CD* | 0.26* | 0.05 | 1.00 | | | | | | | |
| *BPE* | –0.24* | –0.16* | –0.17* | 1.00 | | | | | | |
| *PPE* | 0.33* | –0.30* | –0.07 | 0.33* | 1.00 | | | | | |
| *NIM* | 0.25* | –0.16* | 0.32* | 0.06 | 0.10* | 1.00 | | | | |
| *NTA* | –0.06 | –0.13* | 0.08 | –0.25* | 0.01 | 0.16* | 1.00 | | | |
| *BR* | 0.48* | 0.20* | 0.07 | –0.38* | 0.10* | –0.08* | –0.01 | 1.00 | | |
| *LC* | 0.39* | 0.33* | –0.22* | –0.31* | –0.14* | 0.04 | –0.19* | 0.21* | 1.00 | |
| *FDD* | 0.55* | 0.31* | 0.13* | –0.30* | 0.14* | –0.04 | –0.19* | 0.34* | 0.29* | 1.00 |

***Note.*** *significance at the 0.05 level.

The VIF and tolerance statistics of the independent variables are presented in Table 1 to prevent any problems with multicollinearity. As per Gujarati and Porter (2003), all of the variables' VIF statistics are less than five, indicating that using them for additional analysis is safe. Table 6 presents the correlation matrix of all independent variables for the entire sample of all banks. The correlation coefficients of all variables are at acceptable levels, i.e., less than 0.8, which further eliminates the concerns for multicollinearity (Hair et al., 2014).

## Empirical Findings

### *Baseline Results*

The initial estimation includes a model which analyzes the effect of efficiency on the performance of all banks. Table 7 presents this baseline estimation through panel regression with robust standard errors examining the potential effects of internal efficiency on the banks' financial performance indicated by ROA (column 1), ROE (column 2), and *Z*-score (column 3). Concerning ROA, the results show that CAR, NPA, BPE, and PPE, along with the lagged dependent, are significantly related. For ROE, the variables CAR, NPA, BPE, PPE, and NIM are significant. This indicates that capital sufficiency, effective asset management, and the efficiency of the management to generate credits and earnings play an important role in the profitability of the banks. The significantly negative coefficient of CAR in relation to ROA and ROE; and a significantly positive coefficient in relation to *Z*-score suggests that with a higher CAR comes a requirement of holding a larger capital that could have been invested elsewhere. This may improve the stability of the firm but at an opportunity cost of lower returns. Supportively, the coefficient for NPA is significantly negative, indicating that an efficient management of risk exposure on the assets would result in improved profitability. Income generation efficiency has a highly elastic relationship with that of the profitability of the banks. With higher profits generated by each employee, the ROA and ROE will improve.

The negative coefficient of BPE, however, indicates an inefficient resource allocation and overhead cost

**Table 7.** ***Baseline Results : Effect of Efficiency Parameters on the Financial Performance***

| | ***ROA* (1)** | ***ROE* (2)** | ***Z*-score (3)** |
|---|---|---|---|
| *ROA* (lag) | 0.025* | | |
| | (0.014) | | |
| *ROE* (lag) | | –0.019 | |
| | | (0.017) | |
| *Z*-score (lag) | | | 0.230** |
| | | | (0.103) |
| *CAR*, log | –0.252** | –0.808*** | 0.604*** |
| | (0.097) | (0.214) | (0.106) |
| *NPA*, log | –0.037** | –0.044* | 0.025** |
| | (0.014) | (0.023) | (0.011) |
| *CD*, log | 0.110** | 0.018 | 0.046 |
| | (0.051) | (0.071) | (0.042) |
| *BPE*, log | –0.878*** | –0.712*** | –0.029 |
| | (0.069) | (0.102) | (0.077) |
| *PPE*, log | 0.981*** | 0.951*** | 0.012 |
| | (0.013) | (0.019) | (0.012) |
| *NIM*, log | 0.083 | –0.094* | 0.116** |
| | (0.138) | (0.053) | (0.053) |
| *NTA*, log | 0.023 | –0.004 | –0.007 |
| | (0.025) | (0.053) | (0.030) |
| *BR*, log | 0.013 | –0.000 | 0.003 |
| | (0.017) | (0.019) | (0.010) |
| *LC*, log | –0.006 | –0.000 | 0.008 |
| | (0.004) | (0.004) | (0.006) |
| *FDD*, log | –0.008 | –0.022 | –0.011 |
| | (0.017) | (0.021) | (0.014) |
| Constant | 4.187*** | 7.534*** | –1.786** |
| | (0.778) | (0.883) | (0.708) |
| Observations | 394 | 394 | 394 |
| *R*-squared | 0.9283 | 0.7196 | 0.8727 |
| Time Fixed Effects | Yes | Yes | Yes |
| Mean VIF | 1.67 | 1.67 | 1.67 |
| Heteroskedasticity | Present | Present | Present |
| Autocorrelation | No | No | Yes |

***Note.*** ***significance at the 0.01 level ; **significance at the 0.05 level ; *significance at the 0.10 level.

management, which puts a strain on the productivity and effective revenue generation capacity of human resources. The CD ratio only significantly increases with ROA, indicating that banks will be able to create better returns on their assets if they effectively use deposits to extend loans and credits. The $H_{01}$ hypothesis is thus

rejected. These results are against the findings of Almaqtari et al. (2019) and in conformation with the findings of Gaur and Mohapatra (2021) and Dhar and Bakshi (2015). Time-fixed effects are employed to control for any time-varying factors that might be connected with the result variables, as only internal efficiency measures have been examined (Wooldridge, 2010). Robust standard errors have been supplied for ROA (column 1) and ROE (column 2) because the sample dataset is heterogeneous and lacks autocorrelation. For the *Z*-score (column 3), clustered robust standard errors have been reported because of the coexistence of autocorrelation and heteroscedasticity.

### *Robustness Check Using System Generalized Method of Moments Estimations*

Prior studies have claimed that potential endogeneity issues may exist due to bi-directional relationships between independent variables and bank performance or stability indicators. Thus, a one-step system GMM estimation has been applied to reduce the issue. While defining the model, the orthogonal lagged values of all possible endogenous variables are instrumental variables (IVs). In the model, all internal efficiency indicators are treated as endogenous. The validity of the instruments is tested using Hansen's *J*-test statistics. In all cases, the test statistics accept the null hypothesis that the instruments are exogenous. Table 8 shows the system GMM estimations. The results are mostly unchanged for profitability indicators ROA (column 1) and ROE (column 2). In addition to the original baseline results, NTA, BR, and FDD are now significant. These three factors show a negative relationship with profitability indicators, indicating that higher diversification, liquidity, and cost inefficiency will cause a depletion in the profitability of the banks. With respect to the *Z*-score (column 3), the earlier significant NPA is now insignificant. Also, PPE is now significant and positively related to the *Z*-score, which shows an increase in profitability per employee will potentially improve the stability performance of the banks.

**Table 8.** ***GMM Results***

| | ***ROA* (1)** | ***ROE* (2)** | ***Z*-score (3)** |
|---|---|---|---|
| *ROA* (lag) | 0.004 | | |
| | (0.024) | | |
| *ROE* (lag) | | –0.010 | |
| | | (0.031) | |
| *Z*-score (lag) | | | 0.404 |
| | | | (0.299) |
| *CAR*, log | –0.199** | –1.175*** | 0.588** |
| | (0.091) | (0.130) | (0.271) |
| *NPA*, log | –0.029** | –0.027 | –0.003 |
| | (0.013) | (0.026) | (0.014) |
| *CD*, log | 0.027 | 0.059 | 0.032 |
| | (0.056) | (0.086) | (0.054) |
| *BPE*, log | –1.048*** | –1.151*** | –0.006 |
| | (0.038) | (0.072) | (0.333) |
| *PPE*, log | 0.929*** | 0.829*** | 0.055** |
| | (0.019) | (0.034) | (0.025) |
| *NIM*, log | 0.064 | –0.104 | 0.159* |
| | (0.064) | (0.130) | (0.091) |

| | | | |
|---|---|---|---|
| *NTA*, log | –0.099** | –0.258** | 0.078 |
| | (0.033) | (0.072) | (0.062) |
| *BR*, log | –0.052** | –0.114** | 0.012 |
| | (0.018) | (0.034) | (0.021) |
| *LC*, log | 0.000 | –0.011 | 0.005 |
| | (0.006) | (0.010) | (0.005) |
| *FDD*, log | –0.063*** | –0.091** | –0.002 |
| | (0.014) | (0.026) | (0.018) |
| Constant | 6.353*** | 12.857*** | –1.969 |
| | (0.282) | (0.654) | (1.298) |
| Observations | 394 | 394 | 394 |
| Test for AR (1) | 0.042 | 0.009 | 0.003 |
| (*p*-value) | | | |
| Test for AR (2) | 0.132 | 0.155 | 0.248 |
| (*p*-value) | | | |
| No. of Instruments | 28 | 28 | 28 |
| Hansen Test | 0.577 | 0.356 | 0.310 |
| (*p*-value) | | | |
| Year Dummies | Yes | Yes | Yes |

***Note.*** ***significance at the 0.01 level ; **significance at the 0.05 level ; *significance at the 0.10 level.

### *Comparison Between Public Sector Banks, Private Banks, and Foreign Banks*

The efficiency parameters of bank performance measures are assumed to differ based on the structural differences and regulatory compliances required by the public sector, private sector, and foreign banks. Table 9 reports the regression coefficients by clustering the sample into three groups: public sector banks, private banks, and foreign banks, with ROA (Panel A), ROE (Panel B), and *Z*-score (Panel C) as the dependent variables. The results reveal that stringent capital adequacy has more effect on the profitability and stability of foreign banks as compared to the public sector and private banks. NPA representing the asset management efficiency of banks also has a significant effect on the stability of foreign banks. CD ratio indicates that the credit management efficacy is significant and positive for foreign banks, which implies that these banks need to upscale the credit risk factor to further improve the profitability position in India.

In contrast to this, the private banks have a negative coefficient which suggests that these banks need to tone down their credit exposure to effectively generate optimum profits. The significance and sign of coefficients for BPE and PPE remain unchanged for all three groups of banks. NTA and BR are found to be significant and negative for private banks and public banks, respectively, implying that private banks are highly relying on diversification which is negatively affecting their profitability. This study supplements those of Bansal et al. (2018), Jain et al. (2019), and Kaur (2019), who found that low asset quality and rising credit risk contributed to private banks' decreased profitability. Also, public sector banks have to reduce the overhead burden on the revenue from core business operations to further improve their profitability. These outcomes contradict those of Sahota and Dhiman (2017), who found no discernible differences between public and private sector banks. Consequently, $H_{02}$ is rejected.

**Table 9.** ***Comparison Between Public Sector, Private Sector, and Foreign Banks***

| | Panel A : *ROA* | | | Panel B : *ROE* | | | Panel C : *Z*-score | | |
|---|---|---|---|---|---|---|---|---|---|
| | Public Sector Banks (1) | Private Sector Banks (2) | Foreign Banks (3) | Public Sector Banks (1) | Private Sector Banks (2) | Foreign Banks (3) | Public Sector Banks (1) | Private Sector Banks (2) | Foreign Banks (3) |
| *ROA* (lag) | –0.019 | 0.047 | 0.051* | | | | | | |
| | (0.022) | (0.040) | (0.025) | | | | | | |
| *ROE* (lag) | | | | –0.013 | –0.003 | –0.046* | | | |
| | | | | (0.027) | (0.038) | (0.026) | | | |
| *Z* - score (lag) | | | | | | | 0.060 | 0.292** | 0.147 |
| | | | | | | | (0.215) | (0.292) | (0.166) |
| *CAR*, log | –0.426 | –0.072 | –0.594*** | –0.682* | –0.326* | –1.097*** | 0.364* | 0.522** | 0.547** |
| | (0.321) | (0.176) | (0.153) | (0.353) | (0.171) | (0.148) | (0.189) | (0.134) | (0.156) |
| *NPA*, log | 0.084 | –0.026 | –0.019 | 0.188 | –0.025 | –0.012 | 0.001 | 0.009 | 0.043** |
| | (0.099) | (0.176) | (0.018) | (0.109) | (0.028) | (0.023) | (0.055) | (0.018) | (0.018) |
| *CD*, log | –0.254 | –0.355 | 0.147** | 0.095 | –0.646* | 0.118** | –0.216 | 0.062 | 0.060 |
| | (0.335) | (0.411) | (0.066) | (0.355) | (0.373) | (0.051) | (0.169) | (0.116) | (0.040) |
| *BPE*, log | –0.950*** | –1.013*** | –0.869*** | –0.448** | –0.845*** | –0.728*** | –0.287 | –0.147 | 0.038 |
| | (0.184) | (0.196) | (0.069) | (0.223) | (0.194) | (0.088) | (0.194) | (0.137) | (0.119) |
| *PPE*, log | 1.011*** | 0.973*** | 1.004*** | 1.040*** | 0.964*** | 0.926*** | –0.040 | 0.019 | 0.032 |
| | (0.035) | (0.027) | (0.020) | (0.040) | (0.025) | (0.024) | (0.022) | (0.014) | (0.021) |
| *NIM*, log | –0.046 | 0.237 | 0.057 | –0.137 | –0.151 | –0.093 | 0.151 | 0.219 | 0.055 |
| | (0.268) | (0.194) | (0.053) | (0.298) | (0.203) | (0.066) | (0.145) | (0.155) | (0.049) |
| *NTA*, log | –0.047 | –0.092 | 0.046 | –0.074 | –0.158** | 0.024 | 0.079 | 0.090 | –0.024 |
| | (0.101) | (0.062) | (0.033) | (0.532) | (0.066) | (0.034) | (0.078) | (0.054) | (0.038) |
| *BR*, log | –0.031* | –0.005 | 0.018 | –0.043** | 0.004 | –0.030 | 0.011 | 0.022 | –0.001 |
| | (0.017) | (0.020 | (0.034) | (0.021) | (0.020) | (0.026) | (0.018) | (0.016) | (0.028) |
| *LC*, log | –0.015 | –0.006 | –0.005 | –0.020 | 0.003 | 0.000 | 0.008 | –0.001 | 0.024 |
| | (0.012) | (0.006) | (0.011) | (0.012) | (0.007) | (0.011) | (0.005) | (0.003) | (0.018) |
| *FDD*, log | 0.012 | –0.014 | –0.025 | 0.028 | –0.012 | –0.044 | –0.051 | –0.047** | 0.016 |
| | (0.044) | (0.023) | (0.029) | (0.049) | (0.025) | (0.072) | (0.029) | (0.021) | (0.018) |
| Constant | 6.788* | 6.679** | 4.788*** | 5.048* | 10.339** | 7.575*** | 1.770 | –0.879 | –2.100** |
| | (2.359) | (3.290) | (0.802) | (2.681) | (2.974) | (0.773) | (1.980) | (1.082) | (0.979) |
| Observations | 108 | 160 | 126 | 108 | 160 | 126 | 108 | 160 | 126 |
| Adj. *R*-squared | 0.9312 | 0.9574 | 0.9821 | 0.9264 | 0.9500 | 0.9812 | 0.6182 | 0.9086 | 0.9229 |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Entity Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

***Note.*** ***significance at the 0.01 level ; **significance at the 0.05 level ; *significance at the 0.10 level.

### *Comparison Between Large Banks and Small Banks*

Table 10 presents the regression coefficients of efficiency parameters with performance measures for large and

**Table 10.** ***Comparison Between Large-Scale and Small-Scale Banks***

| | Panel A : *ROA* | | Panel B : *ROE* | | Panel C : *Z*-score | |
|---|---|---|---|---|---|---|
| | Large Scale Banks (1) | Small Scale Banks (2) | Large Scale Banks (3) | Small Scale Banks (4) | Large Scale Banks (5) | Small Scale Banks (6) |
| *ROA* (lag) | 0.019 | 0.028 | | | | |
| | (0.028) | (0.019) | | | | |
| *ROE* (lag) | | | –0.004 | –0.035 | | |
| | | | (0.027) | (0.027) | | |
| *Z* - score (lag) | | | | | –0.004 | –0.035 |
| | | | | | (0.027) | (0.027) |
| *CAR*, log | –0.042 | –0.411** | –0.528** | –0.948*** | –0.528** | –0.948*** |
| | (0.114) | (0.124) | (0.155) | (0.162) | (0.155) | (0.162) |
| *NPA*, log | –0.023 | –0.028 | –0.030 | –0.012 | –0.030 | –0.012 |
| | (0.022) | (0.022) | (0.025) | (0.027) | (0.025) | (0.027) |
| *CD*, log | –0.071 | 0.183** | –0.160 | 0.149** | –0.160 | 0.149** |
| | (0.121) | (0.073) | (0.128) | (0.058) | (0.128) | (0.058) |
| *BPE*, log | –0.923*** | –0.800*** | –0.802*** | –0.604*** | –0.802*** | –0.604*** |
| | (0.105) | (0.106) | (0.122) | (0.131) | (0.122) | (0.131) |
| *PPE*, log | 0.983*** | 0.986*** | 0.987*** | 0.918*** | 0.987*** | 0.918*** |
| | (0.026) | (0.017) | (0.026) | (0.026) | (0.026) | (0.026) |
| *NIM*, log | 0.140 | 0.178* | –0.018 | 0.003 | –0.018 | 0.003 |
| | (0.088) | (0.097) | (0.097) | (0.143) | (0.097) | (0.143) |
| *NTA*, log | –0.052 | 0.053 | –0.037 | –0.001 | –0.037 | –0.001 |
| | (0.059) | (0.043) | (0.066) | (0.035) | (0.066) | (0.035) |
| *BR*, log | 0.002 | 0.068 | –0.002 | 0.042 | –0.002 | 0.042 |
| | (0.023) | (0.052) | (0.022) | (0.043) | (0.022) | (0.043) |
| *LC*, log | –0.005 | –0.010 | –0.005 | 0.007 | –0.005 | 0.007 |
| | (0.005) | (0.012) | (0.006) | (0.013) | (0.006) | (0.013) |
| *FDD*, log | 0.010 | –0.038 | 0.026 | –0.059** | 0.026 | –0.059** |
| | (0.022) | (0.033) | (0.024) | (0.029) | (0.024) | (0.029) |
| Constant | 4.672*** | 3.629** | 8.069*** | 6.164*** | 8.069*** | 6.164*** |
| | (1.045) | (1.020) | (1.111) | (1.161) | (1.111) | (1.161) |
| Observations | 276 | 118 | 276 | 118 | 276 | 118 |
| Adj. *R*-squared | 0.9540 | 0.9805 | 0.9409 | 0.9761 | 0.9409 | 0.9761 |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Entity Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |

***Note.*** ***significance at the 0.01 level ; **significance at the 0.05 level ; *significance at the 0.10 level.

small banks concerning ROA (in Panel A) and ROE (in Panel B). We utilized the median (LogTA: 10.5908) as the cut-off to distinguish between large and small banks because the median is a more accurate metric in a highly distributed dataset because the deviation in bank size as assessed by total assets is substantial.

By separating the dataset into three groups based on the size of the banks, it is found that CAR, BPE, and PPE

are the common parameters of efficiency that affect the profitability and stability of banks. CAR has a significantly negative relationship with performance for both bank groups. However, the elasticity of relation is higher in the case of smaller banks, suggesting that the performance of these banks is being negatively affected by the stringent capital adequacy norms. The negative sign of coefficients of BPE remains unchanged. The larger banks are seemingly facing a diseconomy of scale as the intensity of the effect of inefficiency in resource management is higher as compared to smaller banks. The effect of PPE is similar to both bank groups. In addition to these, CD has a positive effect on the performance of smaller banks. This means that small-sized banks can significantly increase their profitability and stability position by an improved creation of credit from the deposits. These findings are similar to that of Miah and Uddin (2017) and Al-Homaidi et al. (2020). Based on the differences in the effect of these factors across bank sizes, the $H_{03}$ hypothesis is also rejected.

### *Long-Run Effect of Efficiency on the Performance*

An extension of the analysis is presented in Table 11, which presents the long-run estimations of the important short-run efficiency characteristics. As financial sustainability is about the maintenance of a stable and viable financial position over the long term, it is believed that the effectiveness of the baseline results should also hold in the long run. Table 11 reports the long-run estimates of only those variables that are found to be significant in the GMM estimation (Table 8). Column (1) reads the coefficients for ROA, column (2) for ROE, and lastly column (3)

**Table 11.** ***Long-Run Estimates***

| | ***ROA* (1)** | ***ROE* (2)** | ***Z*-score (3)** |
|---|---|---|---|
| *CAR*, log | –0.200** | –1.162*** | 0.988*** |
| | (0.093) | (0.137) | (0.092) |
| *NPA*, log | –0.030** | | |
| | (0.013) | | |
| *CD*, log | | | |
| *BPE*, log | –1.052*** | –1.139*** | |
| | (0.038) | (0.067) | |
| *PPE*, log | 0.933*** | 0.850*** | 0.092*** |
| | (0.023) | (0.038) | (0.023) |
| *NIM*, log | | | 0.268** |
| | | | (0.098) |
| *NTA*, log | –0.100** | –0.255** | |
| | (0.033) | (0.071) | |
| *BR*, log | –0.051** | –0.112** | |
| | (0.018) | (0.032) | |
| *LC*, log | | | |
| *FDD*, log | –0.063*** | –0.090*** | |
| | (0.014) | (0.025) | |
| Observations | 394 | 394 | 394 |

***Note.*** ***significance at the 0.01 level ; **significance at the 0.05 level ; *significance at the 0.10 level.

for *Z*-score. All the parameters of efficiency that are significant in the short-run GMM estimation are found to be significant in the long run as well. The strength of their effect is almost the same except for capital adequacy. CAR has a greater positive effect on the stability of the banks in the long run. These results are at par with the findings of Dang (2019).

## Policy Implications

The research underscores the importance of internal efficiency factors like capital adequacy, asset management effectiveness, earnings efficiency, and liquidity management in influencing banks' profitability and stability. Banks need to maintain a delicate balance between these factors to ensure sustained performance. Al-Homaidi et al. (2020) and Ali and Puah (2019) found similar results to ours. The research further confirms that this relationship holds in the long run as well. It also reveals differences among bank types and sizes. The profitability of foreign banks is affected by past performance, capital adequacy, credit deposit ratio, and staff efficiency.

Similarly, for public sector and private sector banks, the performance of employees, cost burden, and over-diversification are significant factors affecting profitability. Addressing these specific issues is crucial for respective bank types to enhance their performance. Capital adequacy positively affects bank stability despite negatively impacting profitability, while non-performing assets and high liquidity have a negative impact. To ensure long-term sustainability, banks should maintain strict capital adequacy, minimize liquidity risk, and improve asset quality.

The profitability and stability of small-scale banks are most impacted by their capital adequacy ratio, credit risk, and employee performance, according to the dataset's size-based separation. Employee performance and capital adequacy are two key factors that influence the stability and profitability of large-scale banks, respectively. The results of Al-Homaidi et al. (2020), Annapurna and Manchala (2017), and Miah and Uddin (2017) are comparable to these findings. The findings of the study indicate the existing issues in the banking industry of India. This will help to provide a base for the researchers, policymakers, and regulators to set up action plans to mitigate the existing inefficiency in their portfolios. These factors can be rightly converted to efficiency and be utilized to improve the profitability and stability performance of the banks.

## Conclusion

In conclusion, the study underscores the pivotal role of internal factors of efficiency that are such as capital adequacy, the effectiveness of asset management, earnings efficiency from core activities and diversified business, and liquidity management in shaping the banks' profitability and stability in the short-run as well as the long run. Furthermore, the analysis highlights the importance of financial sustainability alongside profitability. It reveals the differences across bank types and bank sizes. The study recognizes the positive impact of stringent capital adequacy norms on long-term bank stability despite its negative relationship with profitability. Asset management inefficiency is more in foreign banks and is affecting their performance to a greater aspect than the public sector and private sector banks. The burden of overhead on interest income is significantly higher in public sector banks, which is a matter of concern.

Similarly, over-diversification is also a factor that is eroding the profitability of private banks. From the perspective of bank size, strict capital adequacy is seemingly affecting the capacity of small banks to generate higher returns. Certainly, this does not imply that these banks should lower their capital adequacy ratio, as this will come at the cost of higher credit risk and loss of stability, which is essential for smaller banks to survive the externalities of the market. Conclusively, it can be said that there are certain inefficiencies inherent in the banking industry of India. This is consistent with the results reported in prior studies. By reducing these inefficiencies, the banks can certainly improve their performances not just in the short run and long run.

## Limitations of the Study and the Way Forward

The study focuses on the internal efficiency parameters of only Indian commercial banks studied for a limited period of 10 years. Future research could extend in several directions to include other types of banks, other economies, and/or even an extended financial period and indicators.

## Authors' Contribution

Smitisikha Guru's contribution encompasses the conduct of the research process, design of the study, review of literature, collection and analysis of data, and interpretation of results. She also drafted the manuscript, created figures and tables, and revised the content based on feedback from her advisor. Dr. Priyabrata Panda was the guide and advisor for this research project. He played a crucial role in suggesting methodologies and reviewing the methodology and data analysis. He provided consistent feedback on the manuscript drafts, offering insights to enhance the clarity and rigor of the research.

## Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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## About the Authors

**Smitisikha Guru is a Ph.D. Research Scholar working in the field of sustainable business and finance at Gangadhar Meher University, Amruta Vihar, Odisha, India.**

**Dr. Priyabrata Panda is an Assistant Professor and Head of the School of Commerce, Gangadhar Meher University, Amruta Vihar, Odisha, India. He is working on tax reforms, banking sector reforms, behavior studies, and the financial impact of COVID-19. He has published 26 research papers, including 14 articles, 7 book chapters, and one conference paper and book.**