# CHAPTER 3

## Methodology

### 3.1 Data & study period

The study is based on secondary data for all listed commercial banks in India over the period 2005 to 2021. We consider the period from 2005 onwards as the data on inflation expectation is available for the Indian economy from 2005 when RBI introduced a household inflation expectation survey. Maintaining uniformity, the period of study for the other objectives except one has been maintained to be 2005 to 2021. The exception arises for data availability on board gender diversity for which the study period is considered from 2015 to 2021. This is the period post the passing of the New Companies Act, 2013based on which it is mandatory to have at least one woman on the board for a specified class of companies. The data related to the women representatives in management has been published for banks only after the implementation of the New Companies Act.

### 3.2 Variables

The study investigates the impact of board diversity on banking performance in India. Two accounting-based indicators– return on assets (ROA) and return on equity (ROE) and one market-based indicator Tobin's Q is used to examine banking performance. ROA is a standard measure for measuring the efficiency and operational performance of banks because it takes into account the returns earned by the assets financed by the bank (Maria and Hussain, 2023). It computes the earnings percentage to determine how effectively firm assets are used (Hakim et al., 2018). An organization is more effective at generating profits from its assets if its ROA is higher. Measuring profitability is critical for the bank because high profitability is the goal of every bank. ROA is the ability of the capital invested in all of the company's assets to generate profits. ROA is defined as the ratio of net profit to total assets (Shahid et al., 2020). Moreover, A higher ROA indicates that commercial banks have a higher leverage ratio (Doyran, 2013).

The second indicator, ROE, has been frequently used to determine if value is being created for shareholders (Wet & Toit, 2007). It is one of the most extensively used and popular metrics of company's total financial success. ROE is popular among investors because it ties the income statement to the balance sheet. It is a measure of the returns and potential

growth on equity investors' investments. Investors like ROE because it connects the income statement to the balance sheet (shareholders' equity). The fact that ROE is the result of structured financial ratio analysis, it is also known as Du Pont analysis. ROE rises as financial leverage rises, so long as the returns on borrowed funds exceed the cost of borrowing. An increase in leverage above a certain threshold may result in an increase in the firm's systematic risk or beta (Ahsan, 2012). The ratio of net profit to equity shares is used to measure ROE in this study (Palaniappan et al.,2017). Return on equity is defined as the amount of net income returned as a percentage of shareholders' equity (ROE). In other words, the return on equity (ROE) is a measure of equity holders' returns and potential growth on their investment. In terms of the ROE, banks hold capital in order to avoid bank failure and to meet regulatory capital requirements(Petersen & Schoeman, 2008).

Tobin's Q is calculated by dividing the firm's capital market value by the replacement value of its assets. It is a considerably more appealing measure in theory than accounting measures (Wernerfelt & Cynthia, 1988). It determines company's value because it provides current financial market estimations of the return value of each rupee of incremental investment. If the Q-ratio is larger than 1, it means that investing in an asset generates a profit that exceeds the investment cost, and if it is less than 1, the market regards the asset investment as low (Hakim, 2018). Table 3.1 summarises the three variables mentioned above.

**Table 3.1: List of dependent variables**

| Variables | Type | Source | Measure |
|---|---|---|---|
| ROA | Firm-level | ACEEQUITY | Profit/total assets |
| ROE | Firm-level | ACEEQUITY | Profit/ equity capital |
| Tobin's (TOBQ) | Firm-level | ACEEQUITY | The market value of firm + debt/Total assets |

**Source:** Author's compilation

### 3.3 Independent Variables and Methodology for Objective 1

**Board diversity:** Gender diversity refers to the equitable or fair representation of people of various genders. We use Blau's index (BI) to measure gender diversity. BI has a value between 0 and 0.5. When BI rises in value, so does diversity in boards. It is computed as

$$Bi = 1 - \sum_{i-1}^{k} \rho_i^2$$

Where $Bi$ denotes Blau's index, "$\rho_i$" denotes the proportion of board members in each category, " $i$ "denotes the category, and "$k$" denotes the total number of board members in each category (Saggar et al., (2022). Table 3.2 summarises the aforementioned measures of board diversity.

**Table 3.2: List of Explanatory variable**

| **Variables** | **Type** | **Source** | Measure |
|---|---|---|---|
| Gender diversity | Bank specific | ACE Equity | Blau's diversity index |

**Source:** Author's compilation

***Control variables***: The set of control variables included are- board independency, board size, board meeting, market capitalization, leverage, bank size, GDP growth rate, and inflation. These variables are summarised in Table 3.3. We have divided the control variables into three categories; board-specific, bank-specific and macro-level.

***Board-specific variables:*** According to the agency perspective, a big board with a majority of independent members improves the board's monitoring ability and limits opportunistic conduct. Independent directors are supposedly in a better position to fulfil their responsibilities as trustees due to their liberation from management. (Maji & Saha, 2021). However, inside directors have a propensity to align their interests more closely with those of management than shareholders. As a result, a bigger share of outsiders on the board can more effectively monitor and oversee top management's opportunistic actions, reducing agency problems(Zhang, 2012). Board size is another important variable that influence the firm's performance. Board size is defined as the total number of directors on the board. In theory, as the number of directors grows, so does the board's capacity for monitoring. In addition, a larger board provides a wider reservoir of information and skills from which to draw(Larmou & Vafeas, 2010).At the same time, It was discovered that when the size of the board grows, it becomes more difficult to make decisions collectively in emergency situations. Another significant aspect determining the functioning of the board and its overall performance is the number of board meetings held each year. The firms are urged to hold frequent board meetings to carry out their tasks and responsibilities. Furthermore, the board is required to publish the date or number of board meetings held in a year as well

as the attendance of each individual director at those sessions. Meeting frequency is seen as a key factor in enhancing the efficacy of the board(Johl et al., 2015).

***Bank-specific variables:*** The firm's market capitalization is an important bank-specific variable in this study. Market capitalization is the stock market value of a publicly traded firm. It is computed using a company's current share price and the total number of outstanding shares. It shows the total market value of all a company's outstanding stock shares. (Kumar and Kumara, 2020). The debt-to-equity ratio is often used to gauge bank leverage and has an impact on bank performance. Under favourable economic conditions, a firm's primary reason for using financial leverage is to increase shareholder return. If fixed-charge funds can be secured at a lower cost than the firm's rate of return on net assets, financial leverage will increase shareholder returns. As a result, a firm's leverage ratio reveals its total demand for external capital in the past(Thadeus, 2012). The (natural logarithm) total assets is used to calculate the bank's size (SIZE). Larger banks have better access to financial products and loan clients, resulting in increased portfolio diversity and fewer bank risks (Ramly et al., 2015). Furthermore, bank size is often used in the banking business to capture potential economies or diseconomies of scale. Bank size factors for cost disparities as well as product and risk diversification. There is no consensus on the scope of impact. Finally, the previous year's performance has an influence on the bank's performance the following year. In reality, retained earnings from the previous year must be authorized by shareholders at a shareholder meeting to determine how much to distribute as dividends or reinvest in the firm. This might increase earnings in the current fiscal year. As a result, the profit from the previous year will have an impact on the profit from the next year (Tran & Vo, 2018).

***Macroeconomic variables:*** The rate of growth in the gross domestic product (GDP) has a direct impact on the demand and supply of loans and deposits, and consequently on the banking sector. Strong GDP growth promotes economic stability, and a bank's business risk is greatly decreased in a stable economic environment (Islam & Nishiyama, 2016). In technical terms, the GDP growth rate incorporates the ups and downswings that occur during business cycles. Changes in the overall level of activity are thus likely to have a direct influence on bank profitability (Gul et al., 2011). The annual GDP growth rate is utilized in this study to calculate the country's economic growth. Inflation is crucial to the country's economy because it exacerbates credit market friction, which is worse in

developing nations. In this study, inflation in the nation is determined using the annual rate of inflation. Inflation is a powerful predictor of bank success (Tan & Floros, 2012).

**Table 3.3: Control variables**

| Variable | Type | Source | Measure |
|---|---|---|---|
| Board independency | Board -specific | ACE EQUITY | The ratio of independent non-executive directors to all board member |
| Board size | Board -specific | ACE EQUITY | Total number of board members |
| Board meeting | Board -specific | ACE EQUITY | Total number of board meetings held in a year |
| Market capitalization | Bank -specific | ACE EQUITY | Log of market capitalization |
| Leverage | Bank -specific | ACE EQUITY | Debt/Market value of firm |
| Size | Bank -specific | ACE EQUITY | Log of total assets |
| Lag ROA | Bank -specific | ACE EQUITY | $ROAt_{-1}$ |
| Lag ROE | Bank -specific | ACE EQUITY | $ROE_{t-1}$ |
| Lag Tobin's Q | Bank -specific | ACE EQUITY | Tobin's $Q_{t-1}$ |
| GDP | Macro level | World bank data base | Annual GDP growth rate |
| Inflation | Macro level | World bank data base | Annual inflation rate |

**Source:** Author's compilation

**Methodology:** Due to the panel nature of the data set it is important to carry out various diagnostic tests as panel data commonly suffer the problems of heteroscedasticity, autocorrelation, cross-sectional dependence, and endogeneity. We employ the following diagnostic tests prior to applying any econometric model in order to identify if our data suffers from the issues mentioned in Table 3.4 below.

**Table 3.4: Problems and its diagnostic test**

| *Concerned problem* | *Diagnostic test* |
|---|---|
| Heteroscedasticity | *Breusch–Pagan* |
| Autocorrelation | Arellano-Bond test (1995) |
| Cross-section dependence | Frees' test ( N>T) |
| Endogeneity | Durbin–Wu–Hausman test (Beyer 2002) |

***Source:*** *Author's compilation*

Post the estimation of the diagnostic tests, the suitability of an econometric model for the panel data set can be judged. In general, feasible generalized least squares (FGLS) and panel corrected standard error (PCSE) are the suitable models for estimation in the presence of heteroskedasticity, autocorrelation and cross-section dependence in panel data model (Parks, 1967). However, if endogeneity is also detected with some or all the other diagnostic tests, the system generalized method of moments (SGMM) is known to be the most appropriate. The SGMM model deals with endogeneity and can generate efficient solutions with a very small period dimension (Roodman, 2009).

Fixed or random effects panel data model are unsuitable for estimation in the presence of various panel data issues as mentioned in Table 3.4 These issues are overcome by GMM estimation put forward by Arellano and Bond (1991). The difference GMM estimation proposed by Arellano and Bond (1991) employs all available lagged values of the dependent variable as well as lagged values of the exogenous regressors as instruments. Arellano and Bover(1995) & Blundell and Bond (1998) criticize that the GMM difference estimator is inefficient when the instruments are weak. When the autoregressive parameters are too large or the ratio of the variance of the panel-level effect to the variance of the idiosyncratic error is too large, the difference GMM estimator performs poorly (Liu & Wilson, 2010). As a result, they created a new method known as the GMM system estimator, which includes lagged levels as well as lagged differences. The GMM systems estimator, further adds the assumption that the first differences of instrument variables are uncorrelated with fixed effects. This allows for the addition of more instruments and can significantly improve efficiency. The system GMM gets its name from the fact that it creates a system of two equations, the original and the transformed (Roodman, 2009). According to Roodman (2009) GMM difference and system estimation can solve the problems of endogeneity, unobserved heterogeneity and autocorrelation.

Thus, to investigate the effect of board diversity on banking performance, we use a dynamic panel data model that accounts for the lag value of the dependent variable among the variables. We adopted the system generalized method of moments (SGMM) to estimate our model. A panel data model based on least square estimation may cause inconsistencies and biases. In this context, Arellano and Bond (1991) provide consistent GMM estimation. The difference GMM model produces a lower precision outcome than the system GMM model. The use of SGMM is justified if the following two conditions are met:

(1) Instrument validity (the instruments used must be associated with the endogenous variables but not with the error term); and

**(2)** Test for residual correlation (the presence of first-order serial correlation in the error term but no second-order correlation) (Maji and Saha, 2021).

The Sargan test is used to evaluate the first condition, while the AR (1) and AR (2) Arellano Bond autocorrelation (AR) tests are used to evaluate the latter (Arellano and Bover, 1995). The Sargan test considers the null hypothesis that the instruments are valid.

The following equations are estimated with the SGMM model

$$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Board\ diversity + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{P} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{Q} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{k} + \lambda_{it}$$

$$\lambda_{it} = \pi_{it} + \varphi_{it} \quad (1)$$

where $\mu_{it}$ represents the profitability of bank *i* at time t, I = 1, 2, 3...N, T = 1, 2, 3...T, and C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, which reflects the unobserved bank-specific effect ($\pi_{it}$) and $\varphi_{it}$ which indicates idiosyncratic error. The $\emptyset_{it}$ are divided into three categories: board-specific variables ($\emptyset_{it}^{P}$), bank-specific variables ($\emptyset_{it}^{Q}$) and macroeconomic variables ($\emptyset_{it}^{k}$).

### 3.4 Independent Variables and Methodology for Objective 2

**Banking efficiency:** Bank efficiency is the process of maximizing the utilization of available resources to produce more output per unit of input. The overall efficiency of banks depends on both profitability efficiency and marketability efficiency. We employ the non-parametric DEA approach that is based on linear programming, to measure banking efficiency in line with Goswami et al. (2019). In this study, we simultaneously measure the profitability efficiency and marketability efficiency of banks. The

profitability efficiency is determined by three inputs, namely, equity, advances, fixed assets with two outputs- interest income and non-interest income. Through profitability efficiency, we are assessing the bank's ability to create interest income and non-interest income based on its present assets, advances and capital stock. Marketability efficiency is obtained using two inputs, namely- income and profit while earnings per share, and interest to investors are the three outputs used. Marketability efficiency measures a bank's ability to participate in the stock market by looking at its income and earnings.

Profitability efficiency shows how successfully a company generates profits and benefits shareholders. Profitability efficiency assesses a business's ability to create profit in a specific situation. Additionally, efficiency ratios assess how well a corporation uses its resources to make profit.

The key rationale for combining the concept of marketability with profitability is that the primary focus of financial innovations in India was on enhancing marketability. Financial innovations was started in the early 2000's by introduction of derivatives trading with the establishment of the National Stock Exchange (NSE) and the introduction of index futures and option in early 2000's. Marketability can also promote diversification, and providing liquidity, transparency, lower transaction costs, and greater flexibility in managing their portfolios. It also contributes to the overall efficiency and stability of financial markets, promoting investor confidence and market integrity**.**

The study evaluates banking efficiency in terms of profitability and marketability.

**Table 3.5: List of Explanatory variables**

| **Variables** | **Type** | **Source** |
|---|---|---|
| Marketability efficiency | Bank specific | ACE Equity |
| Profitability efficiency | Bank specific | ACE Equity |

**Source:** Author's compilation

***Control variables*:** For the second objective, we have used bank-specific and macro-level indicators as control variables. The set of control variables included are- market capitalization, liquidity, bank size, lag-dependent value, GDP growth rate, and inflation. These variables are summarised in Table 3.6. Apart from liquidity, the other control variables are the same as in objective 1. Liquidity is another important determinant of

banking profitability. It refers to a bank's ability to provide adequate funds to fulfil all duties and commitments to customers in times of demand. The CAMEL (Capital adequacy, Asset quality, Management, Earnings, and Liquidity) approach is used to assess bank health (banking soundness). The emphasis in this context is on liquidity, which is represented by the Loan-to-Deposit Ratio (LDR). The control variables are summarized in Table 3.6 below.

**Table 3. 6: Control variables**

| Variables | Type | Source | Notation |
|---|---|---|---|
| Market capitalization (MCP) | Bank-specific factors | ACE EQUITY | Log of market capitalization |
| Liquidity((LIQU) | Bank-specific factors | ACE EQUITY | Loan/deposits |
| SIZE | Bank-specific factors | ACE EQUITY | Log of total assets |
| Lag ROA | Bank-specific factors | ACE EQUITY | $ROA_{t-1}$ |
| Lag ROE | Bank-specific factors | ACE EQUITY | $ROE_{t-1}$ |
| Lag Tobin's Q | Bank-specific factors | ACE EQUITY | Tobin's $q_{t-1}$ |
| Inflation | Macro | World bank data | Annual inflation rate(CPI) |
| GDP | Macro | World bank database | Annual GDP growth rate |

**Source:** Author's compilation

**Methodology:** We carry out the analysis for objective 2 in two stages. Stage 1 deals with the computation of efficiency scores and Stage 2 determines the impact of efficiency on banking performance. To measure banking efficiency, we employ the non-parametric DEA approach that is based on linear programming. In DEA analysis, we have adopted an input-oriented BCC model that yields efficiency scores by minimizing inputs and keeping output constant. The efficiency measure guides management and policy decisions on how

to improve bank performance by identifying national and bank-specific elements that lead to efficiency gains (Tecles & Tabak, 2010). There are two methods of analysing efficiency, namely parametric and non-parametric method. Nonparametric methods such as Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) use linear programming, while parametric methods include the Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA), and Thick Frontier Approach (TFA). We chose DEA for measuring bank efficiency due to its simplicity compared to other methodologies. The study used a panel data regression to examine the impact of efficiency on banking performance. Data Envelopment Analysis compares the performance efficiency of Decision-Making Units (DMUs) to similar organizational units. To pick DMUs for a study, two criteria must be met: (1) homogeneous units with similar functions and (2) at least three times the total number of inputs and outputs (Ramanathan, 2003).

There are two DEA models: CCR (Charnes, Cooper, & Rhodes, 1978) and BCC (Banker, Charnes, & Cooper, 1984). The CCR model assumes constant returns to scale (CRS) and does not account for the economies or diseconomies of scale that a DMU may experience at different production levels. This strategy is appropriate when all DMUs operate at an ideal scale. However, imperfect competition, budgetary restraints, and other factors may force a DMU to diverge from the optimum scale (Coelli, 1996). The CCR model's efficiency scores may not accurately reflect the current efficiency position. To address this drawback, the BCC model relaxes the assumption of CRS and considers the scale of operation to obtain pure technical efficiency scores. CCR and BCC models can be either input or output-orientated. Input-oriented models aim for efficiency by minimizing inputs while maintaining constant output, whereas output-oriented models aim to maximize output with constant input (Schaffnit et al., 1997). We have used an input-oriented BCC model. Banks typically lack control over consumer service expectations. Our second-stage study uses ratings based on the VRS frontier.

For the estimation of DEA, we have defined the inputs and outputs of the banks following the profit approach. This approach analyses the efficiency and effectiveness of resource utilization to maximize profitability. Bank efficiency is the process of maximizing the utilization of available resources to produce more output per unit of input. The overall efficiency of banks depends on both profitability efficiency and marketability. In this study we simultaneously measure profitability efficiency and marketability efficiency of banks. The profitability efficiency is determined by three inputs, namely, equity, advances, and

fixed assets with two outputs- interest income and non-interest income. In the profitability efficiency, we are assessing the bank's ability to create interest income and non-interest income based on its present assets, advances, and capital stock. Marketability efficiency is obtained using two inputs, namely- income and profit while earnings per share, market value and interest to investors are the three outputs used. Marketability efficiency measures a bank's ability to participate in the stock market by looking at its income and earnings.

**Table 3.7: List of input and output variables in DEA**

| | | | |
|---|---|---|---|
| **Profitability efficiency** | **Input variable** | Equity | Sum of all capital stock, reserves and surplus and paid-in capital |
| | | Advances | bank's contribution to loans |
| | | Total Assets | Total assets of bank |
| | **Output variables** | Interest income | Revenue generated from the interest charged on loans, securities, and other interest-earning assets |
| | | Non-interest income | Non-interest income includes various fees, commissions, and other income-generating activities. |
| **marketability efficiency** | **Input variable** | Revenue | It includes Interest income and noninterest income |
| | | Profit | Net profit |
| | **Output variables** | EPS | Net profit by number of equity shares |
| | | Market value | Proportion of a company's share price to its earnings per share. |

| | | | |
|---|---|---|---|
| | | Interest to investors | Interest income earned from their investments |

**Source:** Author's compilation

In this stage, we carry out a regression analysis to estimate the impact of both profitability efficiency and marketability efficiency on banking performance. To do so, we use the efficiency values obtained in stage 1 as the explanatory variable in stage 2. Prior to conducting the regression analysis, we do the diagnostic tests and proceed as in Objective 1.

The following equation is estimated for Objective 2.

$$\mu_{it} = C + \delta_{\mu it-1} + \sum_{1-m}^{m} \beta m\, profitablity\ effi + \sum_{1-n}^{n} \beta_n\, marketablity\ effi + \sum_{1-p}^{p} \beta_p \emptyset_{it}^{Q} + \sum_{1-k}^{k} \beta_k \emptyset_{it}^{k} + \lambda_{it}$$

$$\lambda_{it} = \pi_{it} + \varphi_{it} \quad (1)$$

where $\mu_{it}$ is the profitability of bank i at time t, and i = 1, 2, 3…N, T=1, 2, 3…T, C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, with $\pi_{it}$ representing the unobserved bank-specific effect and $\varphi_{it}$ representing idiosyncratic error. The $\emptyset_{it}$ are divided into two categories. bank-specific variables ($\emptyset_{it}^{Q}$) and macroeconomic variables ($\emptyset_{it}^{k}$).

### 3.5 Independent Variables and Methodology for Objective 3

**Inflation expectation**: To investigate our third objective, the association between inflation expectation and banking performance, we use the annual household inflation expectation rate as the country's inflation expectation. The Reserve Bank has been conducting its Inflation Expectations Survey of Households (IESH) in major urban centres since September 2005 (RBI 2006). To find out the inflation expectations of households, they have been employing the Wholesale Price Index (WPI) inflation, the Consumer Price Index of Industrial Workers (CPI-IW) inflation.

Household inflation expectations provide useful directional information on near-term inflationary pressures. Moreover, it can be used in connection with other economic indicators to provide a more accurate forecast of future inflation. Household inflation expectations of any economy influence the economy's future path of inflation.

Expectations and uncertainty about future inflation can influence a wide range of rational expectations made by households(Mohan et al., 2010). All economic agents, such as households, firms, financial market participants, and professional forecasters, have a different basket of goods and services that they consider, as well as different motives that influence their inflation expectations. As a result, expectations to uses to determine the financial decisions of the economic agents (Singh & Shaw, 2022). Table 3.8 summarizes the main explanatory variable inflation expectation.

**Table 3.8: List of Explanatory Variable**

| Variables | Type | Source | Measure |
|---|---|---|---|
| Inflation expectation | Macro | RBI database | Annual household inflation expected rate |
| Inflation | Macro | World bank data | Annual inflation rate (CPI) |

**Source:** Author's compilation

***Control variables*:** For this objective, we have used bank specific and macro level indicators as control variables. The set of control variables included are market capitalization, liquidity, leverage bank size, GDP growth rate and inflation, as in objective 2. The variables are summarized in Table 3.9 below.

**Table 3.9: List of control variables**

| Variables | Type | Source | Measure |
|---|---|---|---|
| Market capitalization (MCP) | Bank-specific factors | ACE EQUITY | Log of market capitalization |
| Liquidity((LIQU) | Bank-specific factors | ACE EQUITY | Loan/deposits |
| Leverage (LEV) | Bank-specific factors | ACE EQUITY | Debt/market value of the firm |
| SIZE | Bank-specific factors | ACE EQUITY | Log of total assets |
| Lag ROA | Bank-specific factors | ACE EQUITY | $ROA_{t-1}$ |

| | | | |
|---|---|---|---|
| Lag ROE | Bank-specific factors | ACE EQUITY | $ROE_{t-1}$ |
| Lag Tobin's Q | Bank-specific factors | ACE EQUITY | Tobin's $q_{t-1}$ |
| GDP | Macro level | World bank database | Annual GDP growth rate |

**Source:** Author's compilation

**Methodology:** In this objective, we attempt to estimate the impact of both inflation and inflation expectations on banking performance in India.

Since inflation and inflation expectations are correlated, we have used both inflation and inflation expectations in separate equations. As in objective 1 and objective 2 above, we carried out diagnostic tests for our panel data set prior to employing any econometric model for estimation. Given that the SGMM model provides consistent estimates in the presence of various panel data issues, we adopted the SGMM model for estimating the following two equations. In the first equation, we investigate the impact of inflation expectations on banking performance. In the second equation, we investigate the impact of inflation on banking performance, given that inflation serves as the basis for inflation expectations. Thus, it is important to measure the effect of inflation on banking performance.

$$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Inflation\ expectation + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{Q} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{k} + \lambda_{it}$$

$$\lambda_{it} = \pi_{it} + \varphi_{it} \quad (1)$$

$$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Inflation + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{Q} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{k} + \lambda_{it}$$

$$\lambda_{it} = \pi_{it} + \varphi_{it} \quad (2)$$

Where $\mu_{it}$ is the profitability of bank i at time t, and i = 1, 2, 3…N, T=1, 2, 3…T, C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, with $\pi_{it}$ representing the unobserved bank-specific effect and $\varphi_{it}$ representing idiosyncratic error. The $\emptyset_{it}$ are divided into two categories: bank-specific ($\emptyset_{it}^{Q}$), and macroeconomic variables ($\emptyset_{it}^{k}$).

**Robustness test**: The partial least square structural equation model (PLS-SEM) has been employed as a robustness test to show how a causal link between inflationary conditions and banking performance. PLS-SEM is a technique used by academicians to determine the correlation between latent variables. PLS-SEM has the advantage of simultaneously incorporating many indicators for numerous latent variables and determining causal links (Manley et al.,(2021); Wang et al., (2021)).PLS-SEM works well with any sample size as long as it meets the minimal sample size requirements, and it allows for the formulation of hypotheses for variables with complex effects on specific components of the model. The PLS-SEM technique has the following advantages. First, it can be used to predict variables. PLS-SEM is ideal for predictive research. Second, the PLS-SEM can be used in small sample sizes and also its helps to accurately estimate complex hypothetical models. In all situations, PLS-SEM performs effectively, particularly in very complicated models with a large number of latent variables and indicators (Li et al., 2020). Construct validity is vital in PLS-SEM since it implies that all constructs have been adequately measured. The convergent validity (i.e., Average Variance Extracted (AVE)), construct reliability and composite reliability can be used to assess this. The acceptable range for composite reliability values is 0.60 to 0.70 for exploratory research and 0.70 to 0.90 for more advanced stages of study. The latent variables are retained in the model because the construct qualifies composite reliability test together with the criterion of average variance extracted (AVE) value is larger than 0.5 (Ramli et al. (2019); Li et al.(2020); Gadzo et al.(2019)).

In order to perform PLS-SEM test, we have included a number of indicators for inflationary conditions and banking performance based on the literature. The list of indicators is mentioned in Table 3.10 below.

**Table :3.10 Variables and indicators (for PLS-SEM)**

| **Latent variable** | **Abbreviation** | **Indicators** | **Abbreviation** |
|---|---|---|---|
| Inflationary conditions | IN | Inflation (Whole price index) | INF1 |
| | | Inflation expectation | INF2 |
| Banking performance | BP | market capitalization | BP1 |
| | | Total assets | BP2 |
| | | ROA | BP3 |

Source: Authors' compilation

### 3.6 Independent Variables and Methodology for Objective 4

To evaluate our fourth objective- the association between oil price and banking performance, we use the average crude oil price to calculate the country's oil price. Table 3.11 summarises the details of the primary explanatory variable for this objective. Oil prices have a significant impact on production costs, as well as government revenue. Oil price variations impact production and transportation expenses. This creates uncertainty about the future of the global economy. Additionally, this can persuade investors to change their choices and shift investment from sectors with high petroleum intensity to those with low petroleum intensity (Sill, 2007). Oil price changes have led to instability in macroeconomic aggregates in both exporting and importing countries (Brinin et al., 2016). Oil's double importance makes its price more volatile and unpredictable than any other commodity.

**Table 3.11: List of Explanatory variables**

| **Variables** | **Type** | **Source** | Measure |
|---|---|---|---|
| Oil price | Macro | Ministry of petroleum and natural gas | Annual average price of Crude oil |

**Source:** Author's compilation

***Control variables***: For this objective, the set of control variables included are - market capitalization, leverage, liquidity, bank size, GDP growth rate, inflation, and inflation expectation as in objective 2 and objective 3. Additionally, inflation expectation is used a moderating variable in this objective. The variables are summarized in the Table 3.12.

**Table 3.12: Control variables**

| **Variables** | **Type** | **Source** | **Notation** |
|---|---|---|---|
| Market capitalization (MCP) | Bank-specific factors | ACE EQUITY | Log of market capitalization |
| Leverage (LEV) | Bank-specific factors | ACE EQUITY | Debt/market value of the firm |
| Liquidity (LIQU) | Bank-specific factors | ACE EQUITY | Loan/deposits |
| SIZE | Bank-specific factors | ACE EQUITY | Log of total assets |
| Lag ROA | Bank-specific factors | ACE EQUITY | $ROA_{t-1}$ |
| Lag ROE | Bank-specific factors | ACE EQUITY | $ROE_{t-1}$ |
| Lag Tobin's Q | Bank-specific factors | ACE EQUITY | Tobin's $q_{t-1}$ |
| Inflation | Macro | World bank data | Annual inflation rate(CPI) |
| GDP | Macro level | World bank database | Annual GDP growth rate |
| Inflation expectation | Macro | RBI database | Annual household inflation expected rate |

**Source:** Author's compilation

**Methodology:** We begin with the diagnostic tests and subsequently adopt the SGMM technique to estimate the various models we have considered in objective 4.

First, we determine the impact of oil price on banking performance by estimating the following equation.

$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Oil\ price + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{Q} + \lambda_{i\,t}$ $\lambda_{it} = \pi_{it} + \varphi_{it}$ (1)

where $\mu_{it}$ is the profitability of bank i at time t, and i = 1, 2, 3…N, T=1, 2, 3…T, C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, with $\pi_{it}$ representing the unobserved bank-specific effect and $\varphi_{it}$ representing idiosyncratic error. $\emptyset_{it}$ represents bank-specific ($\emptyset_{it}^{Q}$) control variable.

In equation (1), we only consider oil price and bank-specific variables to measure the impact of oil price on banking performance. Nevertheless, to draw further insights into the dynamics of the relationship between oil price and banking performance, we adopt Hesse and Poghosyan's (2016) framework (Figure 3.1) in our study.

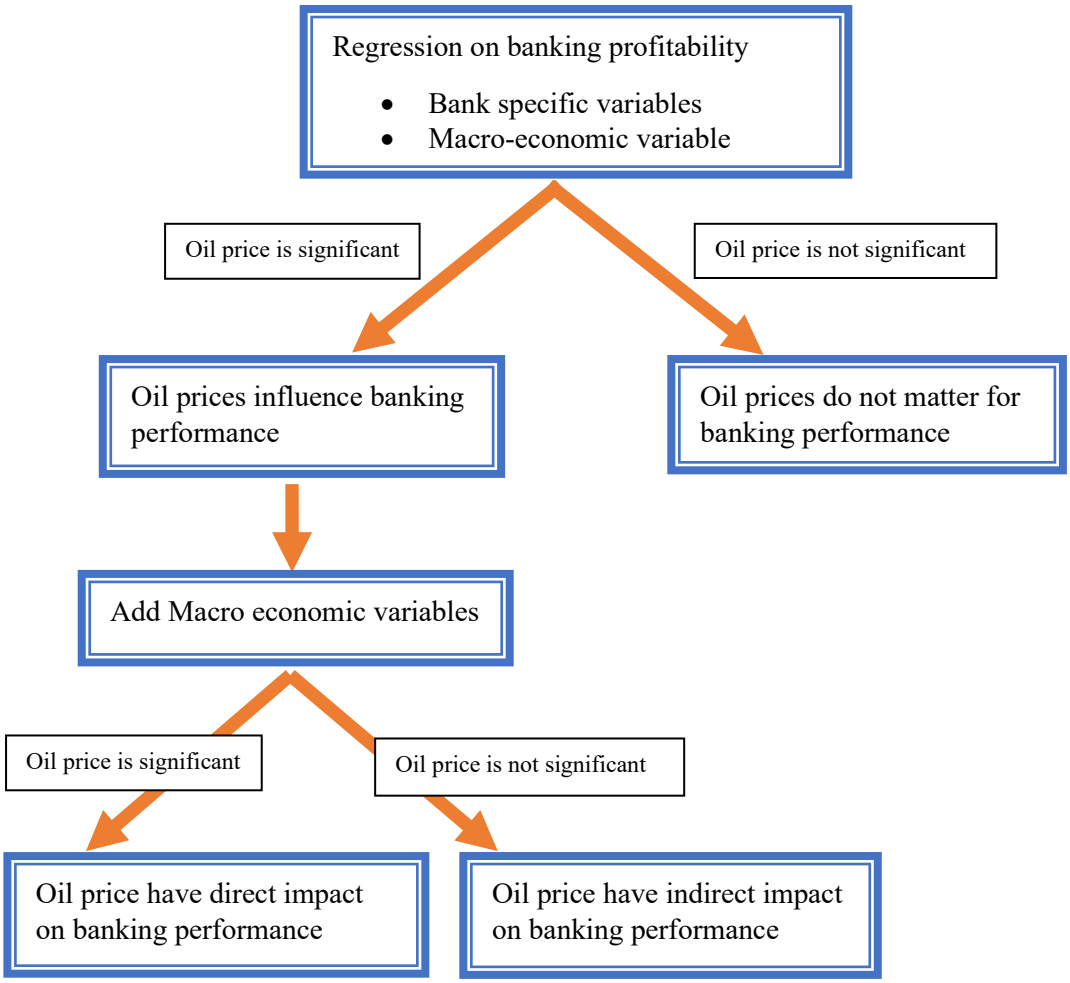


**Figure:3.1:** Framework of the study

**Source:** Hesse and Poghosyan (2016).

Following the above framework, if the coefficient of oil price in equation (1) is found insignificant, then it can be inferred that oil price does not impact Indian banking

performance. On the other hand, if the coefficient of oil price is found significant, then the next step is to determine whether this impact is direct or indirect. Hence, in equation 2, we add country-specific variables to ascertain the presence of a direct or indirect impact of oil price on banking performance.

$$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Oil\ price + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{Q} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{k} + \lambda_{i\,t} \quad \lambda_{it} = \pi_{it} + \varphi_{it} \quad (2)$$

where $\mu_{it}$ is the profitability of bank i at time t, and i = 1, 2, 3…N, T=1, 2, 3…T, C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, with $\pi_{it}$ representing the unobserved bank-specific effect and $\varphi_{it}$ representing idiosyncratic error. The $\emptyset_{it}$ are divided into two categories: bank-specific ($\emptyset_{it}^{Q}$), and macroeconomic variables ($\emptyset_{it}^{k}$).

The macroeconomic variables are considered as a proxy for the possible transmission channels of oil price into banking performance. If the coefficient of oil price remains significant after adding macroeconomic variables, then it can be inferred that the oil price of the country influences banking performance through direct channels. On the other hand, if the coefficient of the oil price is found insignificant, then it can be inferred that the oil price indirectly influences banking performance through the macroeconomic variables.

**Moderation effect:** Finally, we investigate the moderation effect of inflation expectation on the relation between oil price and banking performance. The moderation effect of inflation expectation is captured by the interaction term, Oil price*Inflation expectation, which is the product of oil price and inflation expectation.

$$\mu_{it} = C + \delta\mu_{it-1} + \sum_{1-m}^{m} \beta_m \, Oil\ price + \text{Oil price*Inflation expectation} + \sum_{1-n}^{n} \beta_n \, \emptyset_{it}^{n} + \sum_{1-k}^{k} \beta_k \, \emptyset_{it}^{k} + \lambda_{i\,t}$$

$$\lambda_{it} = \pi_{it} + \varphi_{it} \quad (3)$$

where $\mu_{it}$ is the profitability of bank i at time t, and i = 1, 2, 3…N, T=1, 2, 3…T, C is the constant term. The explanatory variables are $\emptyset_{it}$ and the disturbance term is $\lambda_{it}$, with $\pi_{it}$ representing the unobserved bank-specific effect and $\varphi_{it}$ representing idiosyncratic error. The $\emptyset_{it}$ are divided into two categories: bank-specific ($\emptyset_{it}^{Q}$), and macroeconomic variables ($\emptyset_{it}^{k}$).