

Evaluating macroeconomic influences on Indian public sector banks using mathematical programming pre and post insolvency and bankruptcy code 2016 (2011-2022)

Bhavika Nemade *

Jyoti Nair [†]

N. L. Dalmia Institute of Management Studies and Research

Mumbai University

Mira Road

Mumbai 401107

Maharashtra

India

Abstract

This research looks at how macroeconomic indicators impact the financial health of public sector banks in India, concentrating on changes that occurred both before and after the 2016 implementation of the Insolvency and Bankruptcy Code (IBC). The effects of GDP development, inflation, and borrowing rates on “Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM)” are examined in this study using a Difference in Difference technique for the years 2011–2012 to 2021–2022. Our findings show that, following the IBC, there is rise in inflation and real interest rates, as well as GDP growth, that have a beneficial effect on ROA. In contrast, ROE fell dramatically, indicating a more nuanced impact of macroeconomic conditions on several financial indicators, although NIM remained steady. This analysis is limited to public sector banks to create a comparable comparison, eliminating foreign and cooperative banks that operate under distinct market dynamics. The findings highlight the importance of macroeconomic policy and financial reforms in improving banks’ resilience and performance. This study provides critical insights for policymakers and banking executives, underlining the importance of developing financial strategies that account for economic changes. It lays the framework for future study that will broaden these findings across many financial industries.

Subject Classification: 62B10.

Keywords: Macroeconomic factors, Public sector banks pre and post, Insolvency, Bankruptcy code, Inflation rate, Real interest rate, Returns on assets, Returns of equity, Net interest margin.

* E-mail: bhavikanemade@gmail.com (Corresponding Author)

[†] E-mail: jyoti.nair@nldalmia.edu.in

1. Introduction

1.1 *Brief overview of the Indian banking sector*

The Banking Regulation Act of 1949 defined a bank as “a banking company that transacts the business of banking in India.” This definition applies to banks in India. You can find this term in Section 5(c) of the document. The authorization of deposits from members of the general public is another explanation of banking that can be discovered in Section 5(b) of the same Act. This term may be found throughout the Act. These deposits can be used for lending or investing purposes, and they can be withdrawn in a variety of ways, including by check, draft, order, or other means[1-4].

In their 2017 article, Sharma et al.[31] argue that the banking business in India is the most prominent portion of the financial sector and has a substantial impact on the financial growth of the country. According to Gadhia et al. [9], the banking sector is an essential component for the expansion and development of any economy of any kind. The significant portion of the financial institutions that are classified as Public Sector Banks (PSBs) in India are owned by the government. This is the case particularly in the country of India[6,7,10]. “The Ministry of Finance of the Government of India” or “The State Ministries of Finance” each own a majority stake (that is, more than fifty percent) in these financial institutions. This implies that the Ministry of Finance is the proprietor of the majority holding.

1.2 *Introduction to the Insolvency and Bankruptcy Code (IBC)*

In 2016, India implemented the Insolvency and Bankruptcy Code (IBC), which was a major step forward in addressing the problem of non-performing assets (NPAs). The Insolvency and Bankruptcy Code (IBC) was presented with the purpose of making it easier to resolve insolvency issues in a timely manner[11-14]. The 180-day period is initially set to be extended by 90 days under specific limitations. “The Reserve Bank of India” (RBI) directed banks to file for bankruptcy under “The Bankruptcy and Bankruptcy Code (IBC-)” for the 12 biggest debtors who were designated as non-performing assets (NPAs) in June 2017. As of March 31, 2020, an aggregate of 3,774 cases had been granted entry into Corporate Insolvency Resolution Processes (CIRPs) in compliance with the Insolvency and Bankruptcy Code[15-19].

1.2.1 Significance of Insolvency and Bankruptcy Code 2016

The introduction of the IBC is considered as a crucial component of the plan to address India's protracted NPA issue. The RBI has implemented numerous initiatives over the years to help banks make better decisions about lending policies and provide bankers more power when dealing with promoters unwilling to sincerely revive their stalled projects[21-23]. After it was introduced and the banking control laws were modified, the RBI issued an advisory requiring banks to file for bankruptcy for all non-performing loans within specified timeframes. Although the IBC's debtor-unfriendliness garnered criticism, this step decreased bank NPAs. "Trend and Progress of Banking in India" report released by the RBI in 2019 states that "The IBC's resolutions, which accounted for over half of the total amount recovered, helped to improve the recovery of stressed assets in 2018–19." Additionally, IBC resolves issues more quickly than other resolution methods[24-26]. The average duration of IBC cases is 394 days, while non-IBC systems require approximately 4.3 years.

1.1.2 Impact of IBC on Indian Public Sector Banks (PSBs)

- **Improved Recovery Rates:** The IBC has significantly improved the recovery rates for PSBs. The structured resolution process has enabled banks to recover a higher percentage of their bad loans compared to the pre-IBC era.
- **Reduction in NPAs:** Because the IBC makes it possible to promptly resolve stressed assets, banks' balance sheets have become cleaner and the gross nonperforming assets (NPAs) of PSBs have decreased significantly.
- **Enhanced Credit Discipline:** The threat of insolvency proceedings under the IBC has instilled better credit discipline among borrowers, reducing the incidence of wilful defaults.
- **Increased Provisioning:** PSBs have been required to increase provisioning for stressed assets under the IBC framework, leading to more prudent financial management and risk assessment.
- **Boost to Investor Confidence:** The transparent and time-bound resolution process under the IBC has boosted investor confidence in the banking sector, attracting more investments and improving overall financial stability.

- **Operational Efficiency:** The IBC has prompted PSBs to adopt more efficient operational practices, focusing on timely resolution and better asset management.
- **Legal and Regulatory Changes:** The implementation of the IBC has led to several legal and regulatory changes, requiring PSBs to update their internal processes and compliance frameworks.

1.3 *Statement of Research problem*

In India, banks serve as the primary financial intermediaries, playing a crucial role in the country's economic framework. However, stressed assets have significantly hindered loan expansion, posing challenges to sustaining economic development a primary objective for the nation[27]. The adoption of the Insolvency and Bankruptcy Code (IBC) in 2016 in conjunction with financial institution recapitalization programs is expected to expedite the process of balance sheet clean-up for banks[30]. The deliberate combination of linking bank performance to the amount of capital supplied through recapitalization serves to both discourage the recurrence of stress and financial patience. [27].

This study aims to assess whether the IBC, 2016 has effectively enhanced the financial performance of Indian banks by reducing Non-Performing Assets (NPAs), may negatively influence the nation's economy. By analysing the macroeconomic factors influencing bank performance, in order to compare the financial health of banks before and after IBC 2016, this research paper was conducted[33-34].

1.4 *Objectives*

- a. To investigate the impact of macroeconomic factors on ROA (Return on Assets) both before and after the implementation of IBC by making use of the applicable ratios.
- b. To investigate the influence of macroeconomic factors on ROE (Return on Equity) both before and after the implementation of IBC by making use of the applicable ratios.
- c. To investigate the impact of macroeconomic variables on the Net Interest Margin (NIM) both before and after the implementation of IBC by making use of the applicable ratios.

2. Purpose of the Research

The implementation of the Insolvency and Bankruptcy Code (IBC) in 2016 marked a significant turning point in India's financial landscape. In addition to enhancing the overall health of the banking industry, the International Business Code (IBC) was intended to speed up the process of resolving corporate insolvencies. Under these circumstances, It is critical to carry out an examination of the financial performance indicators of public sector banks (PSBs) both before and after the implementation of the IBC.

The purpose of this research is to understand how macroeconomic variables impacted public sector banks' performance before and after the execution of the Insolvency and Bankruptcy Code (IBC) in 2016. India's financial environment has changed significantly over the last decade, notably after the execution of the IBC. This legislative change is intended to simplify and speed up the settlement of corporate insolvencies, therefore boosting the general soundness of the banking industries. By analysing the economic growth indicators of the banking industries in relation to changes in macroeconomic variables pre- and post-implementation of the IBC 2016, this research seeks to determine the overall influence of the IBC.

3. Literature Review

3.1 *Discussion of the Impact of the IBC on the Banking Sector*

A bank either files for bankruptcy or becomes insolvent when it cannot fulfill its operational obligations. This scenario indicates that the profit margin is less than the cost of capital, and the bank is unable to pay its bills as they become due, even if its assets are greater than its liabilities. Eventually, the bank's obligations exceed its assets, suggesting that its assets are undervalued compared to its liabilities, leading to insolvency.

Sreelakshmi et al. [32] state that the adoption of "The Insolvency and Bankruptcy Code" has assisted financial institutions in minimizing their non-performing assets (NPAs) and increasing their stock values. As a result of the quick improvement of the IBC environment, the number of new non-performing assets (NPAs) in the Indian banking system is falling. Tensingh et al.[36] state that the IBC has benefited India's banking industry, which in turn benefits the country's economy, and it is expected to continue doing so.

3.2 *Overview of Previous Studies on Macroeconomic Factors Affecting Bank Performance*

Bank performance is greatly influenced by profitability, liquidity, and risk assessment. The 2016 Insolvency and Bankruptcy Code was developed in response to the bad loan issues faced by the banking industry. According to the findings of Athanasoglou et al.[5] the performance of banks is also influenced by macroeconomic factors that include the gross domestic product, interest rates, and the rate of inflation. There is a correlation between the trend of a nation's GDP and the demand for bank assets. During a period of economic expansion, the need for credit is influenced by robust GDP growth. On the other hand, when the economy is experiencing a recession or depression, both GDP growth and loan demand decrease, which has a negative effect on the profitability of banks. Research has shown that over the course of their existence, Indian banks' profitability has become less vulnerable to inflation. Sarkar et al. [29] have found that there is a significant positive correlation between unemployment, inflation, and GDP with both return on equity (ROE) and net interest margin (NIM). However, all profitability metrics are negatively impacted by financial crises.

Kantharia et al.[20] argued that GDP and the inflation rate have an insignificant effect on banks' performance. To investigate the effect of macroeconomic factors on non-performing loans, Syed et al.[35] found that macroeconomic factors differ for every type of bank. For instance, all variables are important for state banks and other public sector banks, whereas interest rates, growth rates, and inflation are important variables for private banks.

Sangeetha et al.[28] used macroeconomic variables to examine the effects of the rate at which GDP grows, the rate of rising prices, and the interest rate on the profitability of commercial banks in India. They found that interest rates had a beneficial and negligible impact on every private sector bank, but a negative and negligible impact on every public sector bank, with the exception of Yes Bank. Yes Bank was the only bank that did not experience this impact. When it comes to private sector banks, the inflation rate has a relatively minor impact, whereas it has a significant and favorable impact on all public sector banks everywhere.

After employing structural equation modeling to investigate the effects of macroeconomic factors on the profitability of Indian banks in both the public and private sectors, Devarajan [8] came to the conclusion that these variables, when taken into consideration as a whole, have little

impact on the economic viability of Indian private and public-sector banks. This was the conclusion reached as a result of the investigation. GDP significantly increases all bank profitability criteria. By employing panel data regression models and a mix of micro- and macro-level explanatory variables, Devarajan assessed the non-performing assets (NPAs).

3.3 Research Gap

There are very few studies that have been conducted into the effects of macroeconomic factors on bank variables in terms of profitability in the context of government-owned banks both before and after the 2016 Insolvency and Bankruptcy Code went into effect. These studies are present in the medical literature. The statistical tool used here is Difference in Difference method which is narrowly used in this form of the study.

4. Research Methodology

4.1 Identification of Variables and Formulas

4.1.1 Dependent Variables (Bank Performance)

Return on Assets (ROA): This metric determines the net profit (net income) from the total assets. In accordance with RBI, this is computed by taking the net income and dividing it by the average total assets as shown in eq.1:

$$ROA = \frac{\text{Net Income}}{\text{Average Total Assets}} \quad (1)$$

Net Interest Margin (NIM): Measures net interest income divided by average interest-earning assets. Indicates the bank's loan interest earnings compared to deposit interest payments (RBI) as shown in eq.2:

$$NIM = \frac{\text{Net Interest Income}}{\text{Average Interest-Earning Assets}} \quad (2)$$

Return on Equity (ROE): Measures net profit compared to shareholders' equity. Equity refers to the bank's share capital reserves and surplus as per RBI as shown in eq.3:

$$ROE = \frac{\text{Net Income}}{\text{Shareholders' Equity}} \quad (3)$$

4.1.2 Independent Variables (Macroeconomic Factors)

Gross Domestic Product (GDP): When the assumption that the local currency does not change is taken into consideration, the GDP growth rates are determined using the GDP's yearly percentage growth rate at market prices. For the purpose of determining aggregate prices, the same constant 2015 U.S. exchange rate in dollar is utilized. The gross domestic product (GDP) is computed by first adding the product taxes and the gross value added by all of the registered producers, and then deducting any subsidies that are not included in the product value. Depreciation of manufactured assets and depletion of natural resources are not taken into consideration by this technique. Neither of these factors is taken into account. In most cases, the Laspeyres formula is utilized (the data files for the World Bank national accounts and the OECD National Accounts) as shown in eq.4:

$$\text{GDP Growth Rate} = \frac{\text{GDP}_{\text{current year}} - \text{GDP}_{\text{previous year}}}{\text{GDP}_{\text{previous year}}} \times 100 \quad (4)$$

Inflation: The Consumer Price Index, which illustrates a yearly percentage rise for the cost of commodities and amenities for the typical consumer, is used to determine the overall inflation rate. This index is used to measure inflation. During predetermined time periods, such as once a year, or at regular intervals (according to the International Monetary Fund, the International Financial Statistics, and data files) as shown in eq.5:

$$\text{Inflation Rate} = \frac{\text{CPI}_{\text{current year}} - \text{CPI}_{\text{previous year}}}{\text{CPI}_{\text{previous year}}} \times 100 \quad (5)$$

Real Interest Rate: When the GDP deflator is used, the loan rate has been modified to account for inflation. Due to country-specific terms and circumstances, loan rates are not comparable such as "International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator" as shown in eq.6

$$\text{Real Interest Rate} = \text{Nominal Interest Rate} - \text{Inflation Rate} \quad (6)$$

4.1.3 Control Variable

Prior to the implementation of "The Insolvency and Bankruptcy Code 2016", the term "Pre-IBC" refers to the time era covered by the law. The time period that follows the successful implementation of the Insolvency

and Bankruptcy Code 2016 is referred to as the POST IBC period. The value for PRE IBC is considered as 0 and POST IBC is considered as 1.

4.2 *Developing theoretical construct and hypothesis*

The theoretical construct is represented into two parts Graphical design and Mathematical model, where the graphical design gives the overview of the models considered in the study and mathematical model is the implementation of the model in the form of statistical methods used thus giving equations for the different dependent and independent variables used.

4.2.1 Graphical Design

The graphical representation illustrates in figure-1 the theoretical framework used to evaluate the impact of macroeconomic variables—GDP, inflation rate, and real interest rate—on key banking performance indicators (ROA, NIM, and ROE). Bank size, represented as the natural log of total assets, serves as a control variable across the three models.

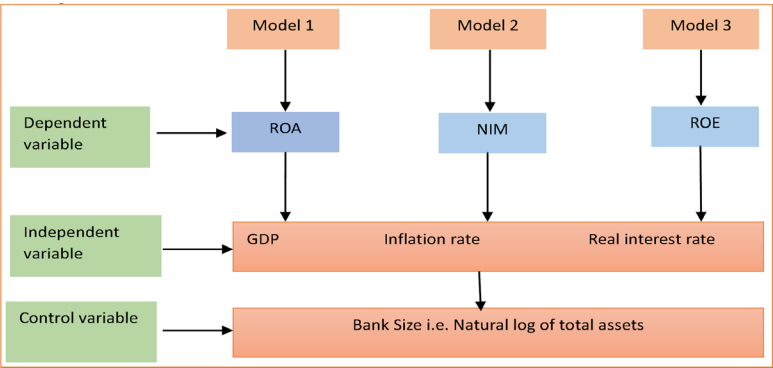


Figure 1
Author’s representation of graphical design of the theoretical model.

4.2.2 Mathematical Modelling of DiD Model

The Difference-in-Differences (DiD) method, extended by the `xtdidregress` command in statistical software like Stata, is a reliable method that is utilized to assess the effect that a treatment or intervention has had on a causal chain over a period of time. Specifically, it examines the differences in outcomes that occur between a treatment group and a

control group both before and after the treatment is administered. Mathematically, the DiD model can be represented as in eq.7:

$$Y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 (Treat_i \times Post_t) + \varepsilon_{it} \quad (7)$$

where:

- Y_{it} is the outcome variable for unit iii at time ttt ,
- $Treat_i$ is an indicator variable for whether unit iii received the treatment (1 for treated, 0 for control),
- $Post_t$ is an indicator variable for whether the observation is after the treatment (1 for post-treatment periods, 0 for pre-treatment periods),
- $Treat_i \times Post_t$ is the interaction term between treatment and post-treatment periods,
- The difference in variations between the treatment and control groups over time is how β_3 captures the impact of treatment.
- β_0 and ε_{it} are the intercept and error term, respectively.

The `xtldidregress` command in Stata extends this model to panel data settings, accommodating for potential serial correlation and heteroskedasticity, providing robust estimates of treatment effects over time.

4.3 Tools Requirement

Stata: Stata is a statistical software used for data analysis, manipulation, and visualization. It supports econometrics, panel data analysis, and offers a command-driven interface.

Other Software and Hardware Requirements: Stata runs on Windows, macOS, and Linux systems. Minimum hardware requirements typically include a contemporary processor (e.g., Intel i5 or equivalent), 4GB RAM (8GB recommended), and adequate room of storage for data files and outputs.

4.4 Developing Hypothesis

Hypothesis 1: To calculate the effect of macroeconomic variables on ROA (Return on Assets) pre and post IBC using appropriate ratios.

- **H0:** The effect of macroeconomic factors on ROA has not changed significantly post IBC.

- **H1:** The effect of macroeconomic factors on ROA has changed significantly post IBC.

Hypothesis 2: To examine the effect of macroeconomic variables on ROE (Return on Equity) pre and post IBC using appropriate ratios.

- **H0:** The effect of macroeconomic factors on ROE has not changed significantly post IBC.
- **H1:** The effect of macroeconomic factors on ROE has changed significantly post IBC.

Hypothesis 3: To examine the effect of macroeconomic variables on NIM (Net Interest Margin) pre and post IBC using appropriate ratios.

- **H0:** The effect of macroeconomic factors on NIM has not changed significantly post IBC.
- **H1:** The effect of macroeconomic factors on NIM has changed significantly post IBC.

4.5 *Research design*

Over the purpose of analysis, the current study uses secondary data from 12 Indian Public Sector Banks published financial statements over the ten-year period between 2011 and 2022. To investigate the economic performance of Indian public area banks, panel data is analyzed. Using the STATA software, a Difference in Difference method is used. The control group in the research study is selected 12 foreign banks on the bases of non - performing assets.

4.5.1 Sample Selection

The study includes all major public sector banks in India, totalling 12 banks, alongside 8 foreign banks selected for comparative analysis.

4.5.2 Data Sources

Data for this study is sourced from reputable sources including Bloomberg financial databases, reports from the “Reserve Bank of India”, and annual reports of the corresponding banks.

4.5.3 Period of Study

The research covers an extensive period of 11 years, spanning from the fiscal year 2011-2012 to 2021-2022. This duration allows for a

comprehensive analysis of trends and changes in bank performance amidst varying macroeconomic conditions.

4.5.4 Dataset Feature

The dataset in table-1 comprises key financial and macroeconomic variables to analyze the impact of the Insolvency and Bankruptcy Code (IBC) on Indian public sector banks. It includes bank-specific performance indicators such as Net Interest Margin (NIM), Return on Assets (ROA), and Return on Equity (ROE), along with macroeconomic variables like bank size and time-based indicators to differentiate pre- and post-IBC periods. These features facilitate a structured assessment of economic influences on banking performance over time.

Table 1
Dataset features, categorization, and data type.

Variable	Description	Data Type
BANK ID	Unique identifier for each bank	Byte
Group variable	Categorization of banks (control = 0, treatment= 1)	Byte
Time variable	Yearly time variable indicating study period	Integer
Pre = 0 Post = 1	Indicator for periods before (0) and after (1) implementation of IBC	Byte
NIM	Net Interest Margin (%)	Double
ROA	Return on Assets (%)	Double
ROE	Return on Equity (%)	Double
Bank Size	Natural logarithm of Total Assets	Double

These macroeconomic factors are crucial in evaluating their impact on bank performance over time, providing insights into how economic conditions affect financial outcomes.

5. Results and Discussion

5.1 Hypothesis 1

An evaluation of the impact of macroeconomic variables on return on assets (ROA) was carried out using the xtdidregress model both prior to and following the adoption of the “Insolvency and Bankruptcy Code”

(IBC) in January of 2016. The regression model for ROA using the `xtdidregress` command is as shown in eq.8:

$$ROA_{it} = \beta_0 + \beta_1 \text{Pre0 Post1}_i + \beta_2 \text{Time variable years}_t + \varepsilon_{it} \quad (8)$$

The results shown in table-2 are interpreted in the context of testing Hypothesis 1:

Table 2
Results for ROA

Variable	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
ATET (Pre0Post1)	0.431391	0.4100469	1.05	0.306	[-0.4268469, 1.289629]

xtdidregress Results Interpretation: The value of the coefficient for Pre0Post1 (1 vs 0) under ROA is 0.431391, and the average error is 0.4100469. When compared to the standard significance level of 0.05, the t-value is 1.05, and the corresponding p-value is 0.306. Both of these values are higher than the predetermined threshold.

Conclusion: The null hypothesis (H_0), which claims that there hasn't been any appreciable change in the impact of macroeconomic factors on ROA since IBC, because the p-value (0.306) is higher than 0.05. This implies that there is not enough proof to draw the summary that the impact of macroeconomic variables on ROA changed significantly after the IBC was implemented in 2016, due to the data and model employed.

Implications: These findings indicate that while the IBC may have introduced reforms aimed at improving financial health and governance in banks, its direct impact on ROA, as mediated through macroeconomic variables considered in this study, may not be statistically significant. Further analysis and consideration of additional factors or longer-term data may be necessary to fully assess the enduring effects of the IBC on bank performance metrics.

5.2 Hypothesis 2

The effects of macroeconomic factors on ROE was evaluated using the `xtdidregress` model both before and after the "Insolvency and Bankruptcy Code" was put into effect in 2016. The regression model for ROE using the `xtdidregress` command is shown in eq.19:

$$ROE_{it} = \delta_0 + \delta_1 \text{Pre0 Post1}_i + \delta_2 \text{Time variable years}_t + \varepsilon_{it} \quad (9)$$

The findings are interpreted in the context of testing are shown in table-3:

Table 3
Results for ROE

Variable	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
ATET (Pre0Post1)	-0.0851548	0.5612502	-0.15	0.881	[-1.259865, 1.089555]

xtdidregress Results Interpretation: With an acceptable error of 2.662037, the Pre0Post1 (1 vs. 0) ratio under ROE is -9.422662. The conventional significance level of 0.05 is exceeded by the t-value of -3.54 and associated p-value of 0.002.

Conclusion: We conclude that the null hypothesis (H0) that the effect of macroeconomic factors on ROE has not changed significantly after the implementation of IBC is not supported by the data because the p-value (0.002) is lower than 0.05. The fact that this is the case provides strong evidence that the effect of macroeconomic variables on ROE has, in fact, changed significantly since the implementation of the IBC in 2016.

Implications: According to these findings, the reforms that were implemented by the IBC have had an effect on macroeconomic variables that were taken into consideration in this study, which suggests that these reforms have had a statistically important effect on ROE. This includes factors that include inflation rates, GDP growth rates, real interest rates, and bank size, which collectively influence the equity returns of banks in the study.

5.3 Hypothesis 3

The xtdidregress model was utilized in order to assess the influence of macroeconomic variables on NIM both prior to and subsequent to the implementation of the “Insolvency and Bankruptcy Code” (IBC) in the year 2016. The regression model for NIM using the xtdidregress command is:

$$NIM_{it} = \gamma_0 + \gamma_1 \text{Pre0Post1}_i + \gamma_2 \text{Time variable years}_t + \varepsilon_{it} \quad (10)$$

The results shown in table-4 are interpreted in the context of testing the influence of macroeconomic variables on NIM:

Table 4
Results for NIM.

Variable	Coefficient	Std. Err.	t-value	P-value	95% Conf. Interval
ATET (Pre0Post1)	0.431391	0.4100469	1.05	0.306	[-0.4268469, 1.289629]

xtldidregress Results Interpretation: Pre0Post1 (1 vs. 0) has a coefficient under NIM of -0.0851548 and an acceptable error of 0.5612502. The p-value of 0.881, which is higher than the typical significance level of 0.05, corresponds to the t-value of -0.15.

Conclusion: The null hypothesis (H0), which claims that there hasn't been any appreciable change in the influence of macroeconomic factors on NIM since IBC, because the p-value (0.881) is higher than 0.05. This states that the impact of macroeconomic variables on net interest margin (NIM) in the banking sector has not changed following the adoption of the IBC in 2016, at least not with statistically substantial results.

Implications: These findings indicate that while the IBC reforms may have influenced other financial performance metrics, such as ROA and ROE, they do not appear to have had a significant impact on NIM as measured in this study. This could imply that factors other than IBC reforms are more influential in determining NIM in the banking sector.

5.4 Summarization of the Results

Table 5 presents the summarization of hypothesis results, evaluating the impact of macroeconomic factors on banking performance pre- and post-IBC implementation. The findings indicate no significant change in Return on Assets (ROA) and Net Interest Margin (NIM), confirming Hypotheses 1 and 3. However, Return on Equity (ROE) exhibited a significant change, supporting Hypothesis 2, highlighting the influence of macroeconomic conditions on bank profitability post-IBC.

Table 5
Summarization of the Hypothesis Results.

Variable	Hypothesis	Result	Interpretation
ROA	H0: No Change	Not Significant	Hypothesis 1 is accepted.
ROE	H1: Change	Significant	Hypothesis 2 is accepted.
NIM	H0: No Change	Not Significant	Hypothesis 3 is accepted.

ROA (Return on Assets): The test did not show a significant change post-IBC ($p = 0.306$). Therefore, Hypothesis 1 is accepted, suggesting no significant impact of macroeconomic factors on ROA post-IBC.

- **ROE (Return on Equity):** The test indicated a significant change post-IBC ($p = 0.002$). Therefore, Hypothesis 2 is accepted, suggesting a significant impact of macroeconomic factors on ROE post-IBC.
- **NIM (Net Interest Margin):** The test did not show a significant change post-IBC ($p = 0.881$). Therefore, Hypothesis 3 is accepted, suggesting no significant impact of macroeconomic factors on NIM post-IBC.

6. Conclusion

The purpose of this study was to look into the influence that macroeconomic factors had on the financial health of public sector banks in India both prior to and following the implementation of the Insolvency and Bankruptcy Code (IBC) in the year 2016. The findings reveal a significant positive influence of inflation rate, real interest rate, GDP, and bank size on return on assets (ROA). There is, on the other hand, an important adverse effect on return on equity (ROE), whereas the net interest margin (NIM) did not show any significant impact after the implementation of IBC.

Notably, this analysis focused solely on public sector banks, excluding foreign and cooperative banks due to their distinct operational frameworks and larger market shares. To enhance comprehension of the relationships that exist between macroeconomic variables and non-performing assets (NPAs), the study emphasizes how crucial it is to consider the various types of bank management. These insights are crucial for policymakers and banking professionals in formulating effective strategies and policies aimed at enhancing overall banking sector resilience and performance. By illuminating these relationships, the study gives a foundation for future research and policy development aimed at mitigating financial risks and optimizing the impact of macroeconomic conditions on diverse banking institutions in India.

References

- [1] U. Aburime, "Determinants of Bank Profitability: Company-Level Evidence from Nigeria," (2008). [Online]. Available: <http://www.ssrn.com/abstract=1231064>.

- [2] J. O. Alabede, "The Intervening Effect of Global Financial Condition on the Determinants of Bank Performance: Evidence from Nigeria," *Accounting and Finance Research*, vol. 1, no. 2, pp. 161–170 (2012).
- [3] M.S. Alam, M.R. Rabbani, M.R. Tausif, A. K. Gupta, and R. S. Sharma, "Banks' Performance and Economic Growth in India: A Panel Cointegration Analysis," *Asian Journal of Management*, vol. 9, no. 1, p. 38 (2021).
- [4] P. K. Aspal, S. Dhawan, and A. Nazneen, "Significance of Bank Specific and Macroeconomic Determinants on Performance of Indian Private Sector Banks," *International Journal of Economics and Financial Issues*, vol. 9, no. 2, p. 168 (2019).
- [5] P.P. Athanasoglou, S.N. Brissimis, P. K. Verma, and R. S. Sharma, "Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability," *Journal of International Financial Markets, Institutions and Money*, vol. 18, no. 2, pp. 121–136 (2008).
- [6] A. Dahiyat, "The Application of CAMELS Rating System to Jordanian Brokerage Firms," *International Research Journal of Finance and Economics*, vol. 88, pp. 16–23 (2012).
- [7] T. Das, "Net Interest Margin, Financial Crisis and Bank Behavior: Experience of Indian Banks," *RBI Working Paper Series*, WPS (DEPR) (2013).
- [8] S. Devarajan, "The Impact of Macroeconomic Variables on the Profitability of Public and Private Sector Banks in India; A Structural Equation Modeling Approach," *ACADEMICIA: An International Multidisciplinary Research Journal*, vol. 8, no. 1, pp. 44–77 (2018).
- [9] N. M. Gadhia, "A Study of Assets Quality of Selected Public & Private Sector Banks in India," *International Journal of Applied Research*, vol. 1, no. 12, pp. 270–274 (2015).
- [10] K. Ganguly and A. K. Mishra, "Does Bankruptcy Reforms Enhance Firm Performances for Politically Connected Firms? Evidence from India," *Journal of Emerging Market Finance*, vol. 23, no. 2, pp. 170–196 (2024). [Online]. Available: <https://doi.org/10.1177/09726527231196926>.
- [11] N. Gupta, S. Mittal, T. Agarwal, P. Bakhshi, and M. Sahoo, "Ownership Concentration and Bank Performance: Evidence from India,"

- Cogent Economics & Finance*, vol. 10, no. 1 (2022). [Online]. Available: <https://doi.org/10.1080/23322039.2022.2114177>.
- [12] Government of India, *Insolvency and Bankruptcy Code*, sec. 29A (2016).
- [13] “Real Interest Rate,” [Online]. Available: <https://data.worldbank.org/indicator/FR.INR.RINR?locations=IN>.
- [14] World Bank, “GDP Growth (Annual %),” accessed Jul. 17 (2024). [Online]. Available: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=IN>.
- [15] World Bank, “Public Licenses,” accessed Jul. 17 (2024). [Online]. Available: <https://datacatalog.worldbank.org/public-licenses#cc-by>.
- [16] M.S. Alam, A. K. Gupta, R. S. Sharma, and P. K. Verma, “Banks’ Performance and Economic Growth in India: A Panel Cointegration Analysis,” *Economies*, vol. 9, no. 1, p. 38 (2021). [Online]. Available: <https://doi.org/10.3390/economies9010038>.
- [17] World Health Organization, “Mortality Rate, Under-5 (per 1,000 Live Births),” accessed Jul. 17 (2024). [Online]. Available: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/>.
- [18] World Health Organization, “Prevalence of Undernourishment (% of Population),” accessed Jul. 17 (2024). [Online]. Available: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/1151>.
- [19] World Data Info, “Inflation Rates in India,” accessed Jul. 17 (2024). [Online]. Available: <https://www.worlddata.info/asia/india/inflation-rates.php>.
- [20] N. J. Kantharia and J. Biradar, “What Influence the Performance of Banks? Evidence from Public Sector Banks in India,” *Journal of Indian Business Research*, vol. 15, no. 1, pp. 23–39 (2023). [Online]. Available: <https://doi.org/10.1108/JIBR-04-2022-0112>.
- [21] E. O. Kiganda, “Effect of Macroeconomic Factors on Commercial Banks’ Profitability In Kenya: Case of Equity Bank Limited,” *Journal of Economics and Sustainable Development*, vol. 5, no. 2, pp. 46–56 (2014).

- [22] S. Kotte, I. L. Reddy, and S. Bolagani, "Influence of Bank-Specific and Macroeconomic Factors on the Profitability of Indian Commercial Banks," *IUP Journal of Applied Economics*, vol. 21, no. 4, pp. 59–76 (2022). [Online]. Available: <https://www.proquest.com/scholarly-journals/influence-bank-specific-macroeconomic-factors-on/docview/2771689404/se-2>.
- [23] L. Singh, R. K. Sharma, A. S. Yadav, and P. K. Verma, *Agrarian Distress and Farmer Suicides in North India*. London: Routledge India, South Asia Edition (2016).
- [24] Reserve Bank of India, "Report on Trend and Progress of Banking in India for the Year Ended June 30, 2017," (2017).
- [25] Reserve Bank of India, "Resolution of Stressed Assets—Revised Framework," RBI/2017-18/131, Mumbai: Reserve Bank of India (2018). [Online]. Available: https://www.rbi.org.in/scripts/BS_CircularIndexDisplay.aspx?Id=11218.
- [26] Reserve Bank of India, "Report on Trend and Progress."
- [27] O. T. San and T. B. Heng, "Factors Affecting the Profitability of Malaysian Commercial Banks," *African Journal of Business Management*, vol. 7, no. 8, pp. 649–660 (2013).
- [28] R. Sangeetha and C. Moorarka, "Macroeconomic Variables and Commercial Banks in India," *Asian Journal of Management*, vol. 10, no. 1, pp. 25–28 (2019).
- [29] S. Sarkar and D. Rakshit, "Macroeconomic Factors Affecting the Profitability of Commercial Banks: A Case Study of Public Sector Banks in India," *Asia-Pacific Journal of Management Research and Innovation* (2023). [Online]. Available: <https://doi.org/10.1177/2319510X231181891>.
- [30] Section 35AA was added to the *Banking Regulation Act, 1949*. See A. Chaturvedi, "RBI Can't Issue Umbrella Directions to Banks to Initiate Insolvency, Says Supreme Court," *Bloomberg Quint*, Apr. 2 (2019). [Online]. Available: <https://www.bloombergquint.com/law-and-policy/rbi-cant-issue-umbrella-directions-to-banks-to-initiate-insolvency-says-supreme-court>.

- [31] P. Sreelakshmi, A. K. Gupta, R. S. Sharma, and P. K. Verma, "Banking Sector in India: An Overview," *Global Journal of Commerce and Management Perspective*, vol. 3, no. 3, pp. 37–39 (2014).
- [32] P. Sreelakshmi and D. Sindura, "The Impact of IBC (Insolvency and Bankruptcy Code) 2016 on the Stock Prices of Selected Indian Banks—an Event Study," *JournalNX*, pp. 56–67 (2020).
- [33] C. N. Simiyu and L. Ngile, "Effect of Macroeconomic Variables on Profitability of Commercial Banks Listed in the Nairobi Securities Exchange," *International Journal of Economics, Commerce and Management*, vol. 3, no. 4, pp. 1–16 (2015).
- [34] Standing Committee on Finance, "Sixth Report of the Standing Committee on Finance."
- [35] A. Syed and R. Tripathi, "Macroeconomic Vulnerabilities and Its Effect on Non-Performing Loans in Indian Commercial Banks," *Indian Journal of Finance*, vol. 14, no. 2, pp. 34–49 (2020).
- [36] E. Tensingh and B. D. Suresha, "A Study on the Impact of Insolvency and Bankruptcy Code 2016 on Indian Commercial Banks—A Pre and Post Event Analysis," *International Journal of Emerging Technologies and Innovative Research*, vol. 6, no. 6, pp. 68–75 (2019).

Received July, 2024