Study on Scope and Adequacy of Risk rating models in Finance

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Abstract

There is growing interest in evaluating the impact of climate policy on the value of financial sector assets, and thus on financial stability. Because the bulk of bank assets are subordinated, it is critical for banks to understand the effects of climate policy on loan instruments.

This research study is aimed at extensive research on risk models. The models for evaluating risk are used to estimate the probability of default. For the risk assessment of the Indian Economy, we have applied Auto Regressive Integrative Moving Average (ARIMA) on NIFTY Bank which is an index of banking stocks.

As a part of the study, we have used the CAMEL model for Yes Bank which has been significantly impacted post-SBI's takeover of 30% stake during their final public offering in 2020 and the return on investment in terms of sustainability for risk assessment of the banking and financial services industry of India.

Keywords

ARIMA, Banking, Bloomberg, CAMEL Model, ESG, India, Liquidity, Predictive Analytics, SARIMA

Introduction

The goal of an effective liquidity risk assessment policy is to ensure that any particular credit institution can satisfy its cash flow obligations, even when external variables cause uncertainty. Financial risks and opportunities are created by climate change. Physical risks from climate change can pose risks today and in the future. But, if the world is to limit the more severe physical effects of climate change in the future, a rapid and comprehensive transition to a low-carbon economy must begin as soon as possible (Carney, 2015; TCFD, 2017a). We investigate banks' exposure to climate transition risk using a bottom-up, loan-level methodology that incorporates a climate stress test based on the Merton probability of default model and the International Panel on Climate Change transition pathways (IPCC). Banks' climate transition risk varies not only due to their exposure to the energy sectors but also related to the carbon emission profiles of their borrowers from other industries.

Banks are critical to any country's economic prosperity. As a result, it is critical to understand how banks work on a regular basis. Bank performance can be measured in a variety of ways using various parameters. The CAMEL model is one such model for evaluating the bank's performance in five parameters. This study will be based on analysing the performance of banks using the CAMEL model and assessing the impact of sustainability on sectoral performance.

Previously, corporations used a silo approach for handling financial risks such as liquidity risk, interest risk, and currency fluctuation risk. Businesses have lately adopted a more holistic approach using a framework known as enterprise risk management (ERM). It entails recognizing and addressing potential risk occurrences that may impede the achievement of strategic objectives, as well as implementing mitigation methods. Because most risks begin with the company's strategy, implementing in strategy-setting is the primary way to risk management. That is how we have presented an analysis of the private banks by using their sustainability scores. Under Sustainability Score system for our banks we have used the following parameters:

Environment	Sustainable Finance
Social	Ethics and Compliance, Data Security and Customer Privacy, Labour and Employment Practices, Marketing and Labelling, Access and Affordability
Governance	Board Composition, Executive Compensation, Shareholder Rights, Audit

Table 1 : ESG Indicators for the research

These attributes are used to investigate the most critical factors that correlate to the sustainability performance of Indian enterprises. This is critical for the firm's or its supply networks' ongoing progress towards sustainability, as well as for increasing supply chain visibility to stakeholders.

Banks are critical to the country's economic success. The failure of a bank, regardless of ownership, private or public, can affect everyone. Therefore, neither the Government of India nor the Reserve Bank of India (RBI) ever allows a bank in financial distress to fail.

Yes Bank Ltd, one of India's leading private banks, has been dealing with a rapidly deteriorating financial status. The Reserve Bank of India (RBI) was forced to take urgent action in the form of a reconstruction scheme to preserve depositors' funds. Yes Bank, founded in 2004, is one of the new generation private banks permitted by the Reserve Bank of India to begin banking operations in the post-liberalization era.

The ARIMA model was developed by Box and Jenkins in 1970. It is also known as the Box-Jenkins methodology, and it consists of a series of operations for detecting, estimating, and diagnosing ARIMA models with time series data. The model is one of the most widely used methodologies in financial forecasting [1, 12, 9]. ARIMA models have proven to be effective at generating short-term projections. In terms of short-term prediction, it consistently beat complicated structural models [17]. The future value of a variable in the ARIMA model is a linear mixture of previous values and past mistakes, represented as follows:

$$Y_t = \phi_0 + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \ldots + \phi_p Y_{t-p} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \ldots - \theta_q \varepsilon_{t-q}$$

where,

Y_t is the actual value and ε_t is the random error at t, ϕ_i and θ_j are the coefficients, p and q are integers that are often referred to as autoregressive and moving average, respectively.

In the actual world, making any form of prediction is challenging, especially when the future is unpredictable. The stock market is inherently uncertain and highly erratic. As a result, investors constantly take chances to yield profit.

A time series is a collection of data that has been gathered throughout time. Sequential data with patterns are called time series data.Time series data are also known as previous data or historical data. The ARIMA model- The term "Auto Regressive" (AR) designates a model that makes use of the dependent connection between an observation and a set number of lagged observations, also referred to as a "lag" or "time lag."

In order to make the time-series stationary, the model differing raw observations (e.g., subtracting an observation from an observation at the preceding time step) is used (I: Integrated). Moving Average (MA) indicates that the model takes advantage of the association between the residual error and the data. The main key advantage of ARIMA model is that it is suitable for non-stationary time series, stable, high accuracy of the forecasting.The application of this model can be done in estimating, using past statistics, how much of a good will be required in the future, estimating future sales and analysing periodic sales variations and calculating the effects of marketing campaigns, new product releases, etc.

Fallout of Yes Bank Ltd

Rana Kapoor and Ashok Kapur established the bank. The bank dealt in high-risk lending, making loans to those who couldn't get loans elsewhere. Yes Bank's asset books showed promising growth until 2017, when the problem of Non-Performing Assets (NPAs) came to light. The YES Bank crisis began when the bank's massive NPA problem became public. Yes

Bank recorded a loss of Rs 18,564 crore for the quarter ending December 2019, compared to a profit of Rs 1001 crore in the same period last year.

Rana Kapoor, the founder, had personal contacts with the majority of the high-level industrialists who sought his assistance for loans that were not repaid. IL&FS, Anil Ambani Group, CG Power, Cox & Kings, Café Coffee Day, Essel Group, Essar Power, Vardaraj Cement, Radius Developers, and Mantri Group were among the major defaulters to whom the bank loaned cash.

Yes Bank's bad loans are anticipated to amount to roughly Rs.40000 crore (Gross NPA). While Gross NPA was over 19% of advances at the end of December 2019, Net NPA was around 6% of loans.

Yes Bank not only had NPAs, but it also under-reported them, which the RBI later discovered. This resulted in the termination of Rana Kapoor's stint as CEO (2018). As of September 2019, the loan book stood at 2,24,505 crore, while deposits stood at at 2,09,497 crore. Because the bank had a large number of bad loans (to the tune of Rs.10,000+ crore), it required new money to run its operations. The failure of the bank to obtain capital resulted in rating downgrades, making capital-raising even more difficult.Prashant Kumar, deputy managing director and chief finance officer of State Bank of India, was appointed as an administrator of Yes Bank during their Yes Bank Ltd. Reconstruction Scheme, 2020, under Section 45 of the Banking Regulation Act, 1949.

Revised Stakeholder Structure of Yes Bank Ltd

SBI had sanctioned a Rs 7,250 crore investment in Yes Bank by purchasing 725 lakh equity shares. ICICI Bank and Housing Development Finance Corporation Ltd both announced investments in Yes Bank's equity of Rs 1,000 crore each. Axis Bank and Kotak Mahindra Bank has invested Rs 600 crore and Rs 500 crore. Bandhan Bank has given Rs 300 crore. Current shareholders own 255 crore shares, providing them an 8.5% stake in the firm.

Literature Review

From an extract of **Rebel Cole and Jeffery Gunther (1998). Predicting Bank Failures: A Comparison of On- and Off-Site Monitoring Systems, *Journal of Financial Services Research 13:2 (1998)*** employs an off-site observing framework based on freely available bookkeeping data as a benchmark to assess the accuracy of CAMELS evaluations in anticipating disappointment. Their findings suggest that if a bank has not been assessed for several quarters, off-site checking frameworks provide a more precise indication of survival than its CAMELS grade. Because of the reduced predictive exactness for CAMELS appraisals "more seasoned" than two-quarters, the overall precision of CAMELS appraisals is much lower than that of off-site checking frameworks. Off-site frameworks provide superior predictive exactness because of both their convenience—a refreshed off-site evaluation is available for each bank every quarter—and the precision of the monetary data on which they are based.

In their investigation, **Muhammad Tanko (2004). The Capital Market, *Kaduna State University (2005)*** contends that despite the persistent use of money related proportions examination on banks execution assessment by bank controllers, limitations to it can flourish with adversaries concocting new apparatuses fit for hailing the general execution (effectiveness) of a bank. Despite the continued use of monetary proportions examination on bank execution assessment by bank controllers, opposition to it expertise is growing, with

adversaries considering new instruments capable of hailing a bank's overall execution (proficiency). This research paper was completed in order to determine the sufficiency of CAMELS in capturing the overall performance of a bank; and to determine the overall loads of significance in each of the variables in CAMELS. Productivity.

Philip R. Lane, DE Saints (2012), Financial Globalization and the Crisis, *Trinity College (2012)* conducted primary research on the spiral phenomena between ratings during the 2008 financial crisis . This is especially true during times of economic crisis. Risks linked with a country's credit rating are transferred to notes issued to banks or institutions outside the financial industry at this point. Later there was also performed research on the pro-cyclicality of rating notes according to the **Report on the pro-cyclicality of capital requirements under the Internal Ratings Based Approach, *European Banking Authority (2013)*.**

According to **Frietrag, Procyclicality and Path Dependence of Sovereign Credit Ratings, *Wiley (2015)*** suggests that the business cycle phase is not considered by agencies when conducting an issuer bankruptcy risk analysis, but studies are carried out on an ongoing basis and the ratings are adjusted to market disturbances. Agencies are unwilling to frequently adjust their ratings, and that current ratings are closely related to existing ratings. There are also significant disproportions in terms of the number of announced improvements and downgrades. It results in an increase in debt servicing costs.

As per the exploratory study by ***Padmini Srinivasan, Prabeetha Bolar, Sustainability Risk Management, Indian Institute of Management Bangalore, March (2020)***, the results demonstrate that almost all organizations have some basic general risk disclosures, which may be attributed mostly to the mandated nature of disclosures in the annual report. Companies, on the other hand, do not disclose more than 37% of the overall risk categories revealed in the research. Only financial hazards are thoroughly mentioned. Environment Sustainability risk disclosure is inadequate, as is the quality of information. Climate change risk disclosures were considerably hazier. It indicates that changes in weather patterns have not surfaced as a substantial source of concern to be declared in the risk section, or that the companies have not disclosed the same in general.

In India, the government has issued the ***National Guidelines on Responsible Business Conduct, 2019 (NGRBC)***, which builds on the previous ***National Voluntary Guidelines on Social, Environmental, and Economic Responsibilities of Business, 2011***, and recognizes in Principle 6 that businesses should respect and work to protect and restore the environment. The emphasis on environmental factors such as pollution, biodiversity conservation, sustainable use of natural resources, and climate change is consistent with the SDGs. Sustainability is the primary motivator of progress from a societal standpoint. If there are problems in the ecosystem that produces life-sustaining resources, social sustainability cannot be realized. Any sustainable development necessitates corporate transformation, notably in the production and sale of goods and services.

Even so, sustainability risk management has recently garnered considerable interest because it has an impact on longterm firm performance **(Anderson, 2006; Bui & de Villiers, 2017; Lenssen, A. Dentchev, & Roger, 2014)**. For example, supply chain sustainability evaluation encompasses social, health and safety, environment and pollution control measures, and human

rights components such as identifying risks associated to climate change, natural catastrophes, and water scarcity **(Giannakis and Papadopilos) (2016)**.

Gupta (2013) [7] analysed the performance of all 26 public sector banks in India using the Camel approach over a five-year period from 2009 to 2013, and he concluded that there is a considerable variation in the performance of all public sector banks measured using the Camel model. **Chaudhary (2014) [4**] conducted a study to compare the performance of public and private sector banks using secondary data collected from annual reports and periodicals from 2009 to 2011 and discovered that private sector banks performed better than public sector banks in every aspect and grew at a faster rate.

Takahashi, Tamada, and Nagasaka,(1998) proposed forecasting stock values using a neural network including a multiple line-segment regression approach. The results showed that the proposed method was effective at forecasting stock prices.

Meyler, Kenny, and Quinn (1998) used ARIMA models to forecast inflation in Ireland using quarterly data from 1976 to 1998, demonstrating some practical difficulties with ARIMA time series forecasting. **Kock and Teräsvirta (2013)** revealed that direct forecasts outperformed recursive forecasts when using Artificial Neural Network (ANN) models to estimate consumer price inflation in Finland from March 1960 to December 2009. **Kharimah, Usman, Widiarti, and Elfaki (2015)** evaluated CPI data from January 2009 to December 2013 using ARIMA models and discovered that the ARIMA (1, 1, 0) was the best model for forecasting CPI in **Malaysia. Baba and Kozaki (1992)** used a back-propagation neural network combined with a random optimisation technique to forecast Japanese stock markets.

Zhang (2003) examined the outcomes of the ARIMA, Artificial Neural Networks, and ARIMA-Artificial Neural Networks hybrid methods to the UK's weekly exchange rate series from 1980 to 1993 and determined that the ARIMA performed best. Artificial Neural Networks outperformed the other methods.

Kumar and Thenmozhi (2014) applied ARIMA, Artificial Neural Networks, Support Vector Regression, Random Forest, and ARIMA-Artificial Neural Networks, ARIMA Support Vector Regression, and ARIMA on India's daily stock index data from 2003 to 2009. Using Random Forest hybrid approaches, we discovered that the ARIMA Support Vector Regression method outperforms other methods in terms of prediction success.

To enable public sector banks to implement best sustainable practises, an acceptable global code of conduct must be incorporated into the Indian banking system. Kumar and Prakash (2020).

India is ranked third on the list of countries most vulnerable to the effects of climate change. Climate change can cost the country between 2.5 and 4.5% of its GDP each year. As a result, India has pledged to reducing carbon intensity by 33-35% by 2030 compared to 2005 levels. However, in order to achieve this goal, India will need to mobilise $2.5 trillion between 2016 and 2030. (MoEF, 2015). 12Climate investments have been fairly modest in both the governmental and private sectors.

Research Methodology

The banking sector's performance review is an effective metric and indicator for assessing the soundness of an economy's economic activity. The current study attempts to assess the performance and financial soundness of selected banks in India for the period 2018-2022. The CAMEL technique was used to assess Yes Bank's financial strength in order to understand the bank's liquidity situation and solvency position following its FPO in 2020.

The data used in this study has been extracted from Bloomberg Terminal, relative valuation and financial analysis segment, The period of study is from 2018-2022 in DD-MM-YYYY format.

As this research study Sustainability reports have been downloaded based on top performing banking institutions by gauging with the Bloomberg Intelligence India Banking Liquidity Index, which tracks the daily outstanding net borrowing from the Reserve Bank of India adjusted for banks' excess cash reserves held with Reserve Bank of India.

The CAMEL Model, a recent innovation in the field of the financial performance review of banks, was chosen as the research instrument for the present study. Capital adequacy, asset quality, management efficiency, earning quality, and liquidity are considered independent variables in the CAMEL model, whereas financial performance is considered the dependent variable. As a result, the banking institution's financial performance, financial situation, operational soundness, and regulatory compliance has been reviewed.

According to empirical evidence in the literature, the CAMEL framework is commonly used to evaluate the financial performance of banks, for example, Kumar at el (2012) such as

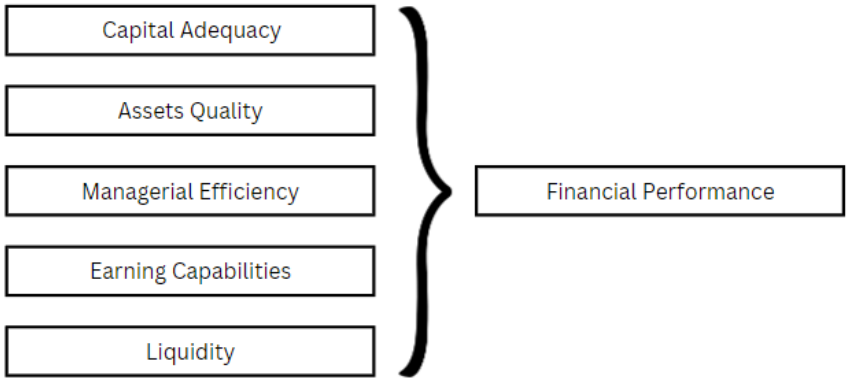

Figure 1 : Independent and Dependent Variables for the study

Research Findings

Stocks in India recovered from the verge of a technical drop amid volatile trading as investors assessed the impact of the Credit Suisse Group AG crisis on local markets. There has been a huge effect in the market due to the change in the performance of macroeconomic factors using the Bloomberg Intelligence India Banking Liquidity Index that is a parameter for assessment of liquidity position of the country

A positive borrowing amount denotes a bank liquidity deficit, whereas a negative amount shows a bank liquidity surplus. Certain components of this data are published by the RBI daily via its news release section. Bloomberg Intelligence is putting this information into a time series data record for analytical purposes.

The calculation of the index is as follows :
Bloomberg Intelligence India Banking Liquidity Index =
Repo Amount Outstanding
(-) Targeted Long term repo outstanding maturing in greater than a year
(-) Long term repo outstanding maturing in greater than a year
(+) Marginal Standing Facility Amount Outstanding
(+) Standing Liquidity Facility Amount Outstanding
(-) Reverse Repo Outstanding
(-) Standing Deposit Facility Amount
(-) Excess Cash Reserves Held With RBI

While the information on excess cash reserves maintained by the RBI is provided with a few days lag, it is assumed to be zero in order to obtain the most recent estimate of banking sector liquidity. If new information becomes accessible, the old values are modified to reflect this. Due to the latency in the RBI's reporting, this only affects the last four daily readings.

The components of this index are certain macroeconomic factors which impact on the liquidity in the market.

National Accounts (GDP)	Housing and Real Estate
Prices	Household and Personal Sector
Labor Market	International Trade and Balance of Payment
Retail and Wholesale Market	Government Finance and Debt
Industrial and Services Sector	Monetary Sector
Whole Economic Activity	Financial Indicators
Cyclical Indicators	Demographics

Table 2 : Factors of Bloomberg Intelligence India Banking Liquidity Index

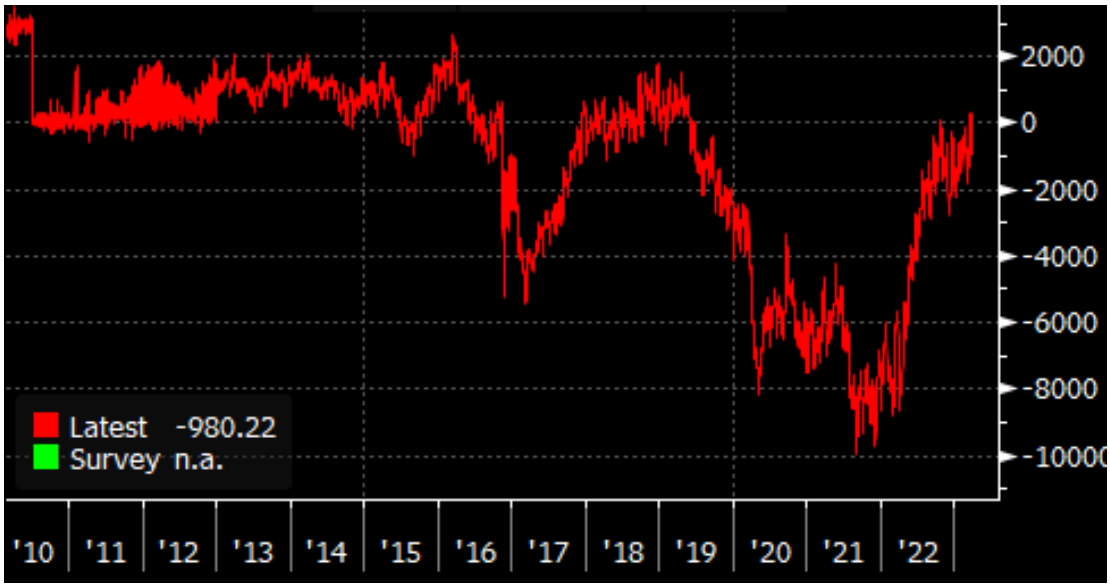

Figure 2 : Bloomberg Intelligence India Banking Liquidity Index Performance since financial year 2010-2022

This indicates that Indian Stock Market is highly volatile as of now due to the predominance of macro factors, silicon valley bank bankrun condition, which can be further stabilized only post retail investors utilize the buying in the dip

In this section, we will examine the financial health of the selected institutions using the CAMEL framework. Only indicators that are relevant to the study are chosen. The indicators were chosen based on their analytical significance, the availability of data for collection and calculation, and their relevance to the study. The following table lists the indicators chosen for the study under each CAMEL acronym:

Capital Adequacy	**Assets Quality**	**Managerial Efficiency**	**Earning Capabilities**	**Liquidity**
Capital Adequacy Ratio	Net NPA To Advances	Net Profit/ Employee (lakhs)	Net Interest Margin	Liquid Assets to Total Assets
CASA	Total Investments to Total Assets	ROE %	Interest Income/Total Assets	Liquid Assets to Total Deposits

Table 3: CAMEL Model Description

Supervisory requirements strengthen accountability as well as transparency in banks by mandating greater attention to the banks' soundness. The choice of a suitable rating system for benchmarking is critical. The 'CAMELS' rating system provides such a methodology, and the Basel Committee of the Bank for International Settlements supports it as an early warning tool for assessing the overall soundness of banks.

CAMEL Model Analysis for Yes Bank Pvt Ltd

a. Capital Adequacy

It is critical for a bank to preserve depositor confidence while avoiding bankruptcy. This refers to a bank's overall financial situation as well as management's ability to satisfy the requirement for additional capital. The capital adequacy ratio is calculated by dividing the total assets by the ratio of equity capital and loan loss provisions.

Statistical Tools used:

i. Capital Adequacy Ratio = (Tier 1 Capital + Tier 2 Capital)/Risk Weighted Assets

Tier 1 Capital - comprises equity, earnings from retained operations, other comprehensive income, intangibles, and small adjustments.

Tier 2 Capital - contains subordinated debt, revaluation reserves, and related stock surpluses.

Risk-weighted assets serve as the denominator. Credit, market, and operational risk-weighted assets are examples of risk-weighted assets. In the form of a percentage, the ratio signifies. **A larger proportion typically denotes the bank's safety.**

ii. **CASA** = CASA Deposits ÷ Total Deposits

The total amount deposited in respect to current and savings account is measured by this ratio. A higher ratio indicates lower cost of funds since a greater proportion of a bank's total deposits are in current and savings accounts. So, the cost of handling the funds will be cheaper the bigger the deposits are in both accounts. **Hence, a greater CASA ratio results in a larger net interest margin, which improves the bank's operational efficiency**

Capital Adequacy Parameter	2018	2019	2020	2021	2022
Capital Adequacy Ratio (CAR)	18.40%	16.50%	8.50%	17.50%	17.40%
CASA	36.45%	33.06%	26.63%	26.13%	31.11%

Table 4: Ratios under Capital Adequacy

In India, the Reserve Bank of India (RBI) mandates a CAR of 9% for scheduled commercial banks and a CAR of 12% for public sector banks. The Capital Adequacy Ratio established guidelines for banks by assessing each institution's capacity to meet its obligations and respond to operational and credit risks. A bank with a strong CAR has sufficient capital to cover any losses. The Capital Adequacy Ratio (CAR) aims to ensure that banks have an adequate amount of capital to safeguard depositors' funds.

As we can observe the trend the CAR dropped in the Year 2020. But the trend depicts that thet the ratio is at an increasing rate hence denotes the banks safety and is optimal to cover the risks. CASA deposits have shown a downward trend on a five-year-on-year basis, it has reduced by 28% and increased by 19%.

b. Asset Quality

Asset quality determines the healthiness of financial institutions in terms of asset value loss, as asset impairment threatens the financial institutions' solvency. The decline in asset value has a knock-on impact, as losses are finally written off against capital, exposing the institution's earning capability.

Statistical Tools used :

i. Net NPA to Advances = Net NPA/Total Loans given

The Net NPA ratio means the present non-performing asset of the bank over the number of loans provided. The increase in this ratio portrays a bad impact on the economy as the bank gets short of funds. A bank experiences significant income losses when its net NPA ratio rises, and in very extreme cases, the RBI may become involved and impose harsh sanctions on the firm. As the ratio below presents the increasing pattern which implicates that the Net NPA to advances is not appropriate for the bank.

ii. Total Investments to Total Assets

A financial ratio called the Total Investment to Total Assets Ratio (TITA Ratio) is used to assess how much an institution has invested in relation to its total assets. To determine this ratio, use the following formula: Total Investments / Total Assets is the TITA Ratio.

Assets Quality Parameter	2018	2019	2020	2021	2022
Net NPA To Advances	1%	2%	5%	6%	5%
Total Investments to Total Assets	21.89%	23.51%	17.03%	15.83%	16.31%

Table 5: Ratios under Asset Quality

The lesser the Net NPA level to Net Advances, the greater the risk coverage from the bank's perspective. However, we can see the ratio is increasing at a constant rate which indicates medium volatility of the bank amongst it peers.

This indicates that the bank has invested between 20 and 25% of its total assets in various securities and loans. As we can see comprehend that there is a decrement in the ratio over the period of years, so the investments are not at par with the total assets of the bank.

c. Management Quality

Another critical component of the CAMEL Model is management efficiency. In this section, the ratio comprises subjective analysis to assess management's efficiency and effectiveness. The bank's management makes critical decisions based on its risk perception.

Statistical Tools used:

i. Net Profit/Employee

It informs you of the amount of profit that each of your employees generates over the course of a specific time frame. Theoretically, the more effective your business is, the higher your net income per employee will be. The profitability of businesses in the same sector can be compared using the profit per employee ratio.

ii. Return on Equity = Net Income / Shareholder's Equity

The most popular statistic for evaluating a bank's profitability is its return on equity (ROE), which measures how effectively shareholder capital is being used to produce profit. Banks frequently set ROE goals at the institutional and product levels, and these goals are frequently a key component of CEO compensation., A healthy ROE range for banks is between 10% to 15%. As per the below pattern we can observe the ROE of the bank is unstable.

Management Quality Parameter	2018	2019	2020	2021	2022
Net Profit/ Employee (lakhs)	23.16	8.13	-71.46	-15.54	4.37
ROE %	16.40%	6.39%	-75.56%	-10.42%	3.15%

Table 6: Ratios under Management Quality

It is important to understand that improved performance does not always translate into a greater ROE. A very high ROE can be a sign that the bank is using excessive leverage or taking on too much risk, both of which could be harmful in the long run. The company had recorded drastic net loss in financial years 2020 and 2021 which got recovered by the strategic decisions by their leading 49% shareholder by State Bank of India. SBI, which initially purchased 49% of Yes Bank, now owns 26.14% of the company as of December 31, 2022. SBI is still the lender's largest single shareholder. The ROE % has improvised when compared to FY 2020 and 2021, which indicates the firm is reinvesting it's earnings which is resulting to higher net income.

d. Earnings Quality

Earnings quality is a critical metric that defines a bank's capacity to earn regularly. It essentially establishes a bank's profitability and explains its future profits sustainability and growth.

Statistical Tools used:

i. Net Interest Margin = Net interest margin = (Investment returns – interest expenses) / average earning on assets

The difference between the interest revenue received and the interest paid by a bank or financial institution in relation to its interest-earning assets, such as cash, is known as the net interest margin, or NIM. NIM evaluates a company's investment performance, especially for financial institutions.

If a bank's non-performing assets (NPAs) are increasing, interest revenue will decrease and NIM will decrease. The NIM will decrease if there is a greater demand for savings than there is for loans. A greater NIM would boost the lender's earnings in the meantime. A low NIM shows that the lender has not been able to effectively utilize its resources since investment returns have not been sufficient to cover interest costs.

ii. Interest Income/Total Assets = Interest Income to Total Funds (%) = Net interest Income/Total Deposits

A crucial financial statistic for banks is the ratio of interest income to total assets since it aids in assessing the bank's capacity to produce income from its assets. The ratio is determined by dividing the bank's interest income by its total assets.

We may estimate the amount of interest the bank is making by computing this ratio and comparing it to the total amount of funds, or deposits. It is a positive sign for the bank if the ratio is higher. It implies that the bank is effectively employing its resources to generate interest.

Earnings Quality Parameter	2018	2019	2020	2021	2022
Net Interest Margin	2.47	2.57	2.63	2.71	2.04
Interest Income/Total Assets	6.48	7.77	10.11	7.32	5.97

Table 7: Ratios under Earning Quality

As per Yes Bank’s performance over the past five years, it has been observed that the net interest margin has reduced by 24% YOY which indicates the bank is having a higher demand of savings account compared to loans that results to high cash outflow from the bank’s perspective wherein the bank has to pay more interest rather than receiving interest, so the bank needs investment restructuring for long term. Similarly, the interest income to total assets ratio has declined as well due to a lack of collection of interest from borrowers.

e. Liquidity

The risk of liquidity is a blight on the bank's image. The bank must take necessary precautions to hedge the liquidity risk while also ensuring that a substantial amount of funds are placed in high return generating securities, so that it may make profit while providing liquidity to depositors.

Statistical Tools used:

i. Liquid Assets to Total Assets = Liquid Assets / Total Assets

The ratio of liquid assets to total assets, which gauges a bank's capacity to satisfy short-term obligations, is a crucial financial measurement for banks.

This ratio is crucial because it shows how well a bank is turning its assets into cash. An increased ratio suggests that the bank is deriving a greater profit from its holdings, which is generally advantageous.

On the other hand, a lower ratio indicates that the bank is not making the most of its assets to produce income.

This ratio can also be used to evaluate how well various banks are performing. When a bank outperforms its peers in the interest income to total assets ratio, it means that it is earning more money for every dollar of assets than its competitors.

The appropriate ratio of a bank's liquid assets to total assets might change depending on the bank's business model, risk profile, and regulatory requirements. Yet a bank's good liquid assets to total assets ratio is thought to be between 20% and 30%.

ii. Liquid Assets to Total Deposits

The Liquid Assets to Total Deposits Ratio evaluates the liquidity available to the bank's total deposits. A greater percentage indicates that a bank has more liquidity, while a smaller percentage suggests that the bank has less liquidity.

Liquidity Parameter	2018	2019	2020	2021	2022
Liquid Assets to Total Assets	3.66%	7.06%	3.25%	10.71%	14.66%
Liquid Assets to Total Deposits	5.69%	11.81%	7.96%	17.99%	23.65%

Table 8 :Ratios under Liquidity

Yes Bank’s liquidity position has improved since 2018 by over thrice which shows the bank is adequate to meet its immediate liabilities of the bank.

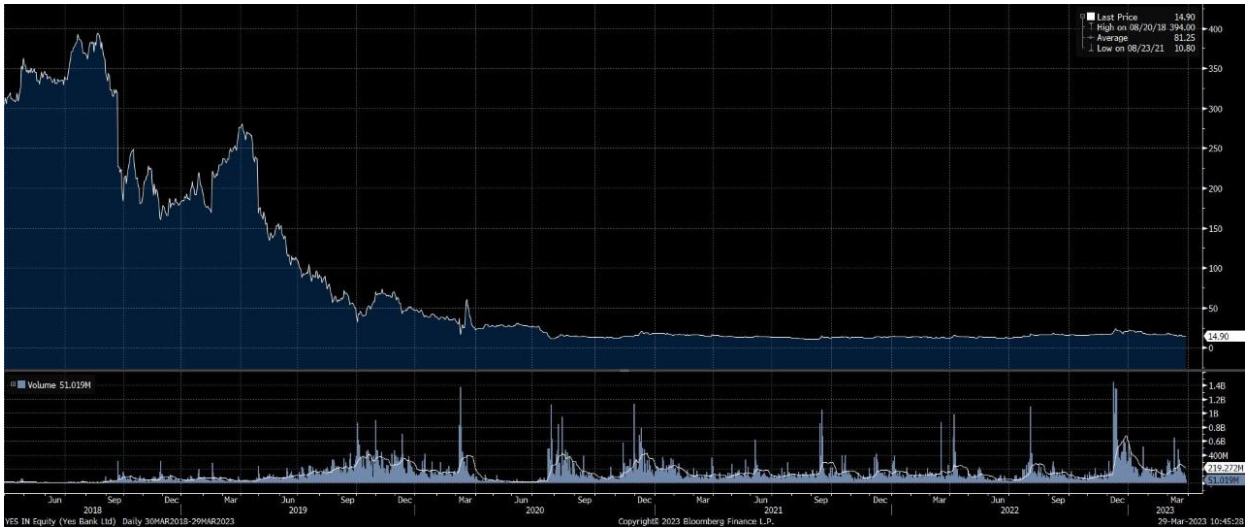

Figure 3: Yes Bank Stock Performance 2018-2022: Source: Bloomberg Terminal

Throughout the last six quarters, Yes Bank has seen a gradual improvement in both business growth and asset quality. Recently, the bank completed the sale of stressed assets to JC Flower, resulting in a significant drop in GNPA to 2%. Looking forward, the bank is primed to pedal higher advance growth (fueled by granular retail assets), having completed a $89 billion capital raise from Carlyle and Advent. With a focus on growth and margin improvement, the bank may be able to increase its Return on Assets to the 0.9-1% forecast range in FY25.

Risk Assessment Model using Python

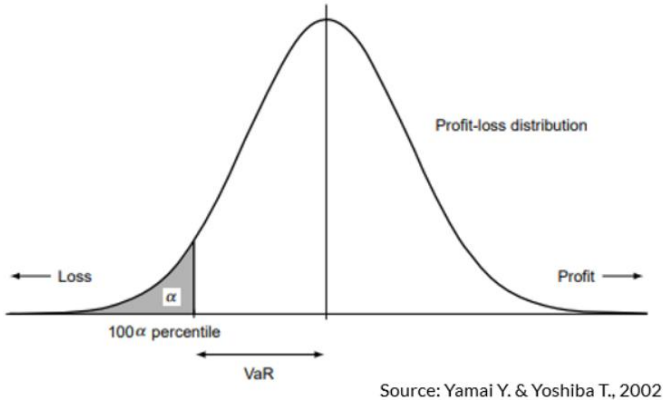

Figure 4 : VaR hypothesis for data extraction

Here for assessing the risk of Indian Banking Industry, there are definitely models such as GARCH, VAR, Monte Carlo Simulation but in terms of analytical assessment of risk we are using ARIMA test to predict the performance of NIFTY Bank in the upcoming year.

Hypothesis for our observation:

#Ho: It is nonstationary

#H1: It is stationary

Results

ADF Test Statistic: -3.0066069034450473

p-value : 0.03428198833958125

Augmented Dickey Fuller Test (ADF test) checks for both stationary and non stationary data in time series data. The test's augmented Dickey-Fuller (ADF) statistic is a negative number. The more negative it is, the more strongly the hypothesis that there is a unit root is rejected at some level of confidence. Under the null hypothesis, the p-value is the likelihood of obtaining a test statistic that is as extreme or more extreme than the observed one. We can reject the null hypothesis and infer that the time series is stationary if the p-value is smaller than the significance level. We cannot reject the null hypothesis and infer that the time series has a unit root if the p-value is greater than the significance level.

Dep. Variable:	px	No. Observations:	61
Model:	ARIMA(3, 1, 2)	Log Likelihood	-545.049
Date:	Fri, 31 Mar 2023	AIC	1102.098
Time:	01:08:03	BIC	1114.664
Sample:	0	HQIC	1107.013
	- 61		
Covariance Type:	opg		

	coef	std err	z	P>|z|	[0.025	0.975]
ar.L1	-0.4452	0.186	-2.398	0.017	-0.809	-0.081
ar.L2	-0.9605	0.099	-9.712	0.000	-1.154	-0.767
ar.L3	0.0640	0.170	0.376	0.707	-0.269	0.397
ma.L1	0.4828	0.142	3.405	0.001	0.205	0.761
ma.L2	0.9898	0.186	5.327	0.000	0.626	1.354
sigma2	5.508e+06	4.23e-08	1.3e+14	0.000	5.51e+06	5.51e+06

Ljung-Box (L1) (Q):	0.37	Jarque-Bera (JB):	141.80
Prob(Q):	0.55	Prob(JB):	0.00
Heteroskedasticity (H):	1.08	Skew:	-1.55
Prob(H) (two-sided):	0.87	Kurtosis:	9.87

Figure 5: ACF and PACF

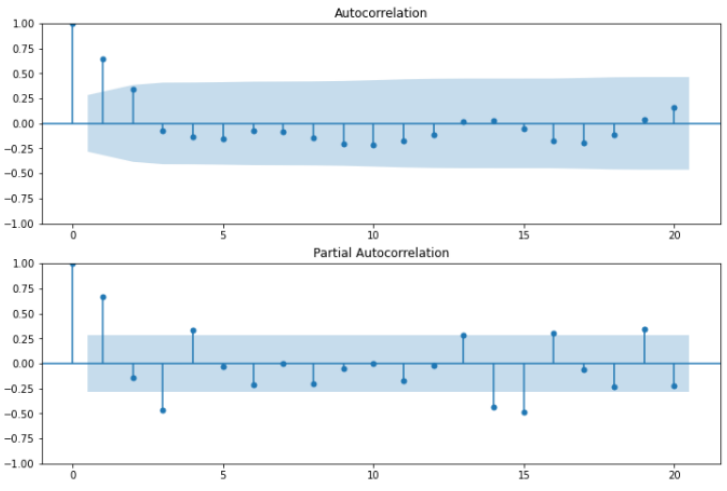

Figure 6: ARIMA Results

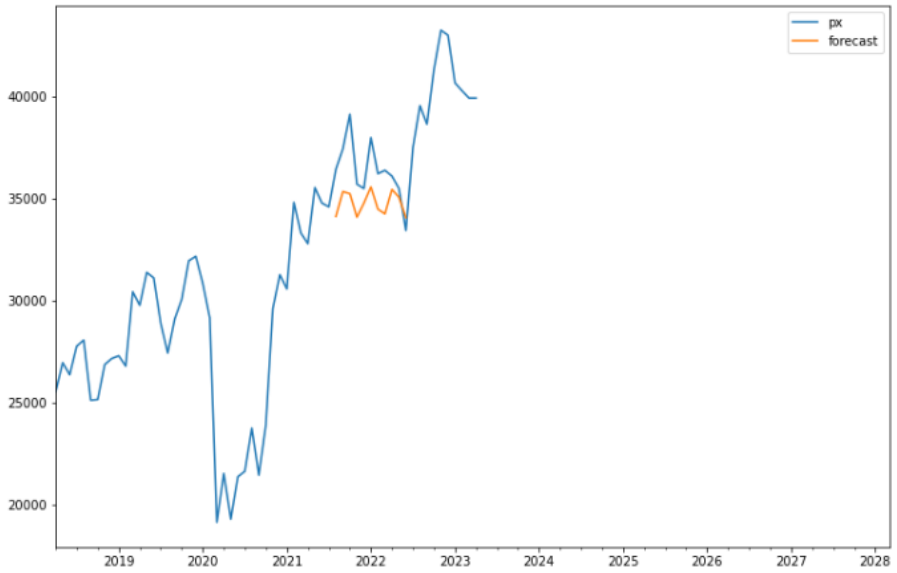

Figure 7 : Forecasted ARIMA for 2023

Sustainability disclosure on specific indicators by leading private banks of India based on market capitalization.

Bank	Indicator	Median amongst peers	Value
Axis Bank	Environmental	Leading	0.8
	Social	Below	2.27
	Governance	Above	6.17
HDFC Bank	Environmental	Above	0.26
	Social	Leading	4.82
	Governance	Above	6.08
Yes Bank	Environmental	Lagging	0
	Social	Below	2.18
	Governance	Below	4.33
Icici Bank	Environmental	Above	0.48
	Social	Above	3.77
	Governance	Above	6.11
Kotak Mahindra Bank	Environmental	Lagging	0
	Social	Below	1.5
	Governance	Below	5.26

Table 9: Sustainability scores for Top five private banks of India

These scores are obtained from Bloomberg Terminal ESG Disclosures of the chosen companies.

Limitations of the study

Now as we have a fundamental understanding and the significance of the ARIMA model. We shall also look at the flip side of the same i.e. the limitations. Since the parameters (p, d, and q) must be manually specified, finding the most accurate fit can be a time-consuming trial-and-

error process, even though ARIMA models can be highly accurate and dependable given the right circumstances and data availability.The model also heavily relies on the accuracy of past data and data differentiation. For the model to produce accurate results and predictions, it is crucial to make sure that the data was gathered precisely and over an extended period.

When we speak about the limited Range: The CAMEL model only evaluates the financial health of banks; it ignores aspects like operational effectiveness, client satisfaction, and market dominance. Below listed are some of its challenges which makes the evaluation parameters more volatile :

- It significantly depends on examiners' subjective judgement, which can result in discrepancies in ratings and interpretations.The CAMEL model's evaluation parameters for banks are not always clear to stakeholders, which can cause confusion and mistrust.
- The CAMEL model may not be appropriate for assessing the financial strength of non-banking financial institutions, such as insurance companies or investment firms.The CAMEL model may not properly account for the risks presented by non-financial factors, such as reputational risk or cybersecurity risk, due to its emphasis on financial metrics.

As we have focused on the sustainability scores of the banking firms, there is a disconnect between material issues described in the Sustainability Report and risks identified in Annual Reports, CDP reports, and BRR. Regulating a proper format or formally adopting: (a) Climate-Related Financial Risk Disclosures, as proposed by TFCD (Taskforce on Climate Financial Disclosure). This study details the existing and potential consequences of climate-related risks and opportunities on the organization's operations, strategy, and financial planning. Risk Management (b) SASB's Sustainability requirements in the United States can be used. (c) Businesses can also investigate more coherent reporting, such as Integrated reporting, which will assist corporations in including these risks as part of their strategy and thus disclosing these parameters

Results and Discussions

After conducting a thorough analysis of the fallout of Yes Bank Ltd, it was understood that the company was seriously in huge bad debts (NPA’s) during the pandemic and the strategic move by The Reserve Bank of India to make State Bank of India the lead stakeholder reduced the volatility of the firm to increase the operational efficiency and user trust. As CAMEL model was followed to assess the bank’s performance amongst its peers. We could conclude that:

- **Capital Adequacy -** Capital Adequacy ratio (CAR) and CASA deposits have shown a strong comeback after a historical period of a declining trend which is a positive point of concern in terms of bank volatility. CAR has increased at a doubling and constant rate on a two year on year basis and the CASA deposits % has increased by 19% because in this period of rising inflation investors are becoming more inclined towards liquid funds, term deposits with commercial banks and which also depicts low volatility in their savings accounts
- **Asset Quality** - The ratio of Net NPAs to Total Advances has been observed constant throughout due to the loan moratorium payouts recently. A healthy TITA ratio for commercial banks is typically seen as being between 20 and 25% and the bank is heady towards a steady movement which has improvised the TITA year on year,

- **Management Quality -** Net Profit per employee and ROE ratios have observed as a huge boost to their shareholders as it is indicating more financial leverage, increase in profit margins. It has increrased significantly by almost 30% yoy.
- **Earning Quality -** We can interpret that the net interest margin has an overall upward trend but with certain decline whicb is constant owing to the banks stability over the period which correlates with the performance of the bank in terms of customer's mindset of increasing CASA deposits due to increase in interest rates
- Liquidty - The negative impact of higher liquidity on financial institutions claimed that while having more liquid assets improves the capacity to obtain capital quickly, it also reduces management's ability to commit credibly to an investment strategy that protects investors. Here the bank has strategically improvised their liquidity position made SBI to reduce their stake from 29% to 24%

  Now coming to Bank Nifty which is a collection of twelve best performing banking stocks on the basis of market capitalization in India. Because of the smaller number of constituents in the Bank Nifty and the high beta characteristic of banking equities, the Bank Nifty has historically been more volatile than the Nifty. Banks may underperform in the short run while still experiencing uncertainty. But, a large portion of this deterioration is accounted for in prices, and we anticipate a recovery in bank financials this year.

  To assess the risk and predict the future prices of Bank Nifty we have used the ARIMA model, which is the best fit model apart from Holt's Model, the Ordinary Least Squares Model r Time Series Analysis. As seasonality is not observed in the banking industry, we have chosen ARIMA model for analyzing the impact of macroeconomic factors on the stock price of Yes Bank which is estimated to be in the range of INR 35000-37000.

  By the sustainable score analysis of the banks, we can come up with a statement that ESG scores are crucial because benchmarking with its peers will reduce the volatility of the company and leverage the value of goodwill and other intangible assets of the firm. Axis Bank and HDFC Bank have their rating above and leading amongst its peers which is positive for their firm and Axis Bank, India's third largest private sector bank, issued a set of commitments aimed at attaining the Sustainable Development Goals (SDGs), bolstering India's Paris Agreement obligations. As part of its pledges, the bank has set an incremental lending target of Rs. 30,000 crore in the following five years under Wholesale Banking to relevant industries listed in its Sustainable Finance Framework.

Conclusion

Because of major changes in the banking industry in recent years, central banks all over the world have enhanced the quality and methodology of their supervision.

Many developed countries are currently using the unified financial rating system (CAMEL RATING) in conjunction with other existing procedures and methodologies to evaluate the function of banks. The preceding study is a simple attempt to describe the numerous ratios that are useful for assessing the financial performance of the banking sector. Several researchers apply the ratios stated in this study to evaluate bank performance in their respective investigations.

Yes Bank has been working well towards reducing their Net NPAs to Total Advamces and increase their CASA deposits amongst its prospective clients which is a scope of improvement soon as well because their rural expansion is almost minimal which needs to be deployed at the earliest.

For stock forecasting, irrespective of industry, Following ARIMA and SARIMA, the sought-after algorithm is long short-term memory (LSTM). Many experts believe that LSTM is the most promising algorithm for stock prediction right now. It is an RNN, but it can analyse both individual data points and more complicated data sequences, making it well-suited to handle non-linear time series data and anticipate extremely volatile price variations.

Our findings open up numerous avenues for future research. More specifically, the proposed sustainable scores framework might be used to conduct multiple econometric studies to determine whether more integration of ESG criteria into banks' governance systems has a favourabl impact on their economic performance, risk profile, corporate reputation, and/or cost of capital. In this way, we may go deeper into the factors that banking intermediaries should consider when creating shared value and therefore contribute to sustainable development. Similarly, it could be interesting to test the financial or non-financial factors of the index described in this work.

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