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# Identify the Economic Crisis by Analyzing Banking Data Using Machine Learning Technique

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**Abstract:** The aim of this research is to pinpoint economic downturns by delving deep into banking data and scrutinizing the countermeasures banks employ to avert these downturns. By amalgamating quantitative assessment of banking metrics with qualitative insights from bank documentation and dialogues with banking leaders, we offer a comprehensive perspective. Key indicators that signal economic crises include escalating numbers of non-performing loans, waning profitability, and shrinking capital ratios. In response, banks have adopted strategies such as reshaping their loan portfolios, bolstering capital reserves, and refining their risk assessment protocols. This research underscores the paramountcy of promptly detecting economic downturns and deploying efficacious strategies to safeguard financial equilibrium. We structured our approach in three pivotal phases: firstly, countering overfitting through regularization; next, utilizing boosting to minimize loss during each iteration; and finally, addressing edge cases. Our proposed framework commences with data partitioning. This is succeeded by statistical preprocessing, yielding a detailed multivariate analysis for the ensuing model. This refined data then feeds into our boosting model, which, after training, facilitates classification. The outcomes of this classification stage are then channeled into a regression model, delineating the ramifications of exchange rate fluctuations due to economic upheavals.

***Keywords:*** *Banking Data, Financial Crisis, Risk Management, Stocks of Global Banking, Regression Analysis.*

## 1. Introduction

In the global economic arena, few events are as tumultuous and impactful as a "financial crisis." At its core, a financial crisis encapsulates a severe disruption of a country's or region's monetary and financial systems. Such disruptions are not merely statistical anomalies. They cast long shadows, leading to drastic repercussions both for the economy and the broader society.

When we speak of a financial crisis, it's essential to understand its defining features. The immediate imagery associated is often one of collapsing stock markets or banks shutting their doors. And while these images aren't entirely off the mark, the crisis's nuances run much deeper. At the heart of any financial crisis lies a precipitous decline in the value of financial assets. Whether it's stocks, bonds, or real estate, their diminishing worth sends shockwaves through the financial ecosystem.

Moreover, banks, being the lifeline of any modern economy, find themselves in the eye of the storm. Widespread bank failures during a crisis are not just indicative of the banks' inability to sustain themselves, but they also signify the evaporating trust of the public and investors in these institutions. And as banks falter, the ripple effects can be felt far and wide. One of the most immediate consequences is the tightening of credit. With banks wary of lending due to heightened risks, businesses and individuals find it increasingly challenging to secure loans. This credit squeeze further exacerbates the economic slowdown, leading to job losses, reduced consumer spending, and a general atmosphere of financial pessimism.

Historical retrospection provides a wealth of examples when it comes to financial crises. Perhaps none is as universally recognized as the Great Depression of the 1930s. Originating in the United States following the stock market crash of 1929, it wasn't merely an American problem. Its effects were global, bringing economies worldwide to their knees. Unemployment soared, trade collapsed, and despair was rife.

Fast forward a few decades, and the world witnessed the Asian Financial Crisis of 1997–1998. Starting in Thailand due to the collapse of the Thai baht, the crisis quickly spread across Asia. Nations like Indonesia, South Korea, and the Philippines saw their currencies tumble and stock markets crash. The IMF had to step in with a rescue package, but the Asian economies took years to recover fully.

More recently, the echoes of the Global Financial Crisis of 2008–2009 still reverberate. Rooted in the US housing market's subprime mortgage bubble, the crisis soon morphed into a full-blown international banking emergency. Major financial institutions either collapsed or were bailed

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out, unemployment rates shot up, and global GDP suffered a significant contraction.

However, what remains a topic of keen interest to economists and analysts alike is: what triggers these crises? While each crisis has its unique set of circumstances and causes, there are underlying commonalities. One glaringly recurrent theme is excessive risk-taking. Financial institutions, driven by the allure of high returns, sometimes indulge in lending practices or investment strategies that are unsustainable in the long run. These risks, when they materialize, can be catastrophic.

The bursting of an asset bubble is another precursor. Real estate, equities, and commodities may experience asset price bubbles if their prices rise to unsustainable heights relative to their underlying value. Speculation and euphoria led to the bubble, and when it bursts, asset prices will fluctuate significantly. Speculation and overconfidence led to the bubble.

When economies experience a financial crisis, it may have far-reaching and long-lasting consequences. There is a risk that they might lead to widespread joblessness, worsening poverty, and civil instability. More than that, these repercussions won't only affect one country; they might affect the whole world. In order to restore stability and stimulate economic recovery, governments and central banks typically use a wide range of policies, such as fiscal stimulus, monetary easing, and bank bailouts, to combat these crises. Financial crises may impact society as well as the economy. The following is a condensed version of these repercussions:

1. **Economic Contraction**: Financial crises typically precipitate sharp reductions in economic activities. Both consumers and companies reduce their expenditures and investments, leading to job losses and diminished revenue streams.
2. **Bank Collapses**: Financial institutions, including banks, can fail during these crises. This can mean massive losses for individuals and corporations, affecting their savings and investments.
3. **Government Debt Burden**: To stabilize the system, governments might resort to bank bailouts and other financial interventions, leading to a significant accumulation of public debt.
4. **Social Unrest**: A direct fallout of job losses, salary cuts, and reduced credit access can be increased societal discontent.
5. **Global Spillover**: Given the interconnectedness of global economies, a crisis in one region can quickly cascade to other parts of the world.
6. **Regulatory Revisions**: In the aftermath of crises, there are often calls for, and implementations of, revised regulatory and monitoring frameworks in the financial sector.

Taking the 2008 global financial crisis as an exemplar, its ripple effects were felt even in economies relatively insulated from global financial intricacies, such as India. Although India was less integrated with the global financial structures compared to many industrialized nations, its economy did not remain untouched:

- **Dip in Exports**: The crisis significantly impacted the global demand for products and services, causing a slump in Indian exports. This severely impacted sectors like gems and jewelry, leather, and textiles.
- **Tightened Credit**: Global credit contraction meant that Indian companies found it challenging to secure loans, affecting their profitability. Small and medium-sized businesses, particularly reliant on bank loans pre-crisis, were hit hardest.
- **Stock Market Crash**: 2008 saw a significant dip in the Indian stock market, eroding billions from investors' portfolios. This severely impacted the broader financial sector, including insurance and mutual funds.

In response to the crisis, India's growth rate declined from a robust 9% in 2007-08 to a more modest 6.7% in 2008-09. The Indian government's intervention, through fiscal stimulus, monetary easing, and bank recapitalizations, played a pivotal role in staving off a more drastic economic downturn. Nevertheless, the economic slowdown's effects lingered for years.

To navigate and potentially mitigate the impacts of financial crises, several strategies can be employed:

1. **Central Bank Intervention**: Central banks can pump liquidity into the financial system by lending to banks and other institutions. This can prevent many bank failures and stave off a more extensive crisis.
2. **Governmental Stimulus**: Initiatives like tax reductions and heightened government spending can spur economic activity and job creation.
3. **Enhanced Regulation**: By ramping up the financial sector's regulation and supervision, the chances of excessive risk-taking and asset bubbles, which are precursors to crises, can be minimized.

Recapitalization of banks occurs when governments offer capital injections to financial institutions to assist such institutions in repairing their balance sheets and expanding their ability to lend.

Debt restructuring: In situations where a considerable amount of debt has become unsustainable, debt restructuring may be essential to reduce the financial strain on debtors and avert mass defaults.

Coordination on a global scale: When a crisis has the potential to have international repercussions, there may be a need for coordination on a global scale between governments and international organizations to help prevent the crisis from spreading and promote an effective and effective and coordinated response.

**Existing work :**

- Suffering from overfitting, the model performs better on training but shows lower scores on unseen data.
- Bagging methods for classification.
- They are not handling outliers and boundary cases.

**Proposed work :**

- Handling overfitting by regularization.
- Boosting to reduce loss in every iteration.
- Boundary cases handled.

In all, there are six chapters in this piece of writing. The next chapter, chapter 2, discusses related studies and theoretical elements of anomaly identification in financial data and applicable ML algorithms. This chapter follows the chapter that introduces the topic. The research methodology is presented in Chapter 3, along with descriptions of some of the chosen methodologies and the framework. The procedures of implementation as well as the empirical data, are presented in Chapters 4 and 5, and the conclusions are discussed in chapter 6.

## 2. Literature Review

Selva Bahar Baziki and her colleagues found that a bank's risk increases when its portfolio has more securities from countries with higher sovereign credit risk or when the bank is based in a country with high sovereign credit risk. Both of these things add to the general danger that the bank is exposed to. But the results of our study didn't show that the bank's ex-post risk went up because it owned more government assets issued by the country where it was based. But the risk profile of financial institutions that got capital contributions from the government after the Global Financial Crisis is much higher than that of financial institutions that didn't get capital help. This is because the risk profile of the institutions that did not get cash help is much stronger. If a bank's portfolio has many assets released by sovereigns with a higher risk profile, but the government has given the bank money, the bank is thought to have a lower risk profile. This is still the case even if the bank has a higher risk rating. These findings conclude that regulatory arbitrage is important to these organizations [7, 8].

Hubert Dichtl et al. A support vector machine-based crash prediction model is better at making statistical predictions than both a random classifier and the average single standard. It is also better than a multivariate logistic regression model. This model also does better than a multivariate logistic regression model and a random classifier. Also, a random classifier does not work as well as a model built on support vector machines. Support vector machines are better than their competitors because they consider complex and mixed effects, which are necessary and the basis of this benefit. Active consumers get a lot of value because they can predict stock market crashes even when they don't have access to past data. Using accident prediction models based on machine learning could help with the quick use of macroprudential tools [8], which is important from a policy point of view.

Robert E. Krainer et al. Even though neither the Keynesian nor the Classical models consider this answer, it has been shown that the contractual solution to this conflict-of-interest problem between the two parties can affect some of the ways economic cycles look. Changes in how risky investors are willing to be and in the value of stocks may drive real investment choices, which can cause changes in the economy. After this point, the bond deals will force the company to change the financial decisions it has already made to make up for any risk-shifting that has happened because of the investments. The owners of a company's shares are in charge of managing the company's assets, while the owners of the company's bonds are in charge of managing the company's finances. (or, in the case of banks, regulators). Because of this, the wealth of both parties will meet at some point during the economic cycle. During the business cycle, a similar study could be used to examine the age distribution of workers and the size distribution of companies. The information given here or elsewhere has not shown that these statements about the financial and non-financial business areas in the United States are wrong [9].

Matthew Greenwood-Nimmo and his colleagues show that the spillover density is often uneven, with heavy tails. Its position and structure change significantly and consistently in response to public signs of systemic stress. They also show that the heavy tails are caused by the flow density, often not the same on both sides. They also show that each of these traits is somehow related to the others. They use additional panel data models to show how the two are related and that the strength of bilateral spillovers is linked to portfolio investment exposures between country pairs. This is done to show a cause-and-effect link between the two. Because they can be changed daily, our spillover numbers are a good addition to the weekly and monthly measurements of systemic stress already in place [10].

Takahiro Hattori et al. The Bank of Japan (BOJ) takes action after midnight and into the early morning hours when the market has a large negative return. The BOJ sends out orders to buy stocks around lunchtime. Based on the BOJ's announcement in March 2020 that it will double the amount it buys each year during the COVID-19 pandemic, this study also finds that the news has a small and short-term effect.

This is because the BOJ said it would double the money it buys yearly. On the other hand, real deals have a big impact on money and will continue to do so. The Bank of Japan (BOJ) has been buying countercyclical exchange-traded funds (ETFs) to help make sure that market risk premia don't go up when the economy is shrinking [11].

In the study Silvia Iorgova and her colleagues did on how abnormal information is made during important events, they found that capital injections led to less abnormal information. In comparison, early European stress tests led to more abnormal information. High levels of information creation make it likely that bank balance sheets will get smaller and that the government will spend more money to help financial companies [12]. High levels of information output also suggest that the government will spend more money to help banking companies.

Based on data about Chinese banks that Maoyong Cheng and his colleagues collected between 2008 and 2019, they conclude that when banks use cloud computing, cost efficiency decreases, earnings efficiency increases, and the business risk increases. They also discover that cloud computing works with other technologies that have only been around for a short time. This relationship creates mutual benefits in terms of cost efficiency and organizational risk management, but blockchain has a substitutive effect on the efficiency with which businesses make a profit. The results are important and relevant for making policy and have real implications for officials and bank management [13].

Nadia Benbouzid et al. This is because CCyB has a bigger effect on financial institutions' capital ratio (also known as the equity-to-total assets ratio) than on other things. The capital ratio is a way to figure out how much stock a bank has compared to its overall assets. When the CCyB rules are relaxed, there is no change in capital. When they are tightened, however, capital goes up by a lot. When CCyB control is allowed, the risks that come from the banking sector could be reduced by a large amount during times of high uncertainty and financial crisis. Because of this, macro-prudential rules that require banks to keep larger amounts of capital when the economy is doing well are a good way to control financial market risks [14].

By studying how people can buy in Active Shares, C. Wei Li and his colleagues examine how the battle, like a tournament, affects the mutual fund business. Mutual funds' Active Shares often go up in the fourth and final quarter of a given calendar year, even if they had a relatively bad result by the end of the third quarter of that year. When the Active Share of a tracking fund goes up, the fund's exposure to negative risk also goes up almost immediately since the Active Share goes up simultaneously. The shown data shows that the planned changes they describe in Active Sharing were not based on their knowledge or skills [15].

Georgios P. Kouretas and other experts are looking into how vulnerable the financial system is after the economic crisis of 2007–2008 and the euro area crisis of 2009–2015. The pieces in this Special Issue look at how the financial system can be broken. In particular, the papers look at two topics: (1) the risks that come from outside factors like the liberalization of financial systems, cross-country contagion, and climate change; and (2) the policy responses to financial instability, such as macroprudential supervision and quantitative easing [16].

The most important thing that Francesco Marchionne and his colleagues found was that an inverted U-shaped curve is the best way to show how likely a financial crisis will happen. This means that the chance of a crisis increases as rules get more strict from low to medium levels, but it goes down as they get stricter from medium to high levels. This is the reverse of what would happen if rules went from easy to hard. There is a higher chance that a country's economy will be unstable if its regulations are in the middle of the spectrum between how strict and loose they are. This is because a country is in the middle when its rules are not too strict or loose. The first group is stuck in the trap of deregulation, and the second group is stuck in the trap of control. The way institutions are run greatly affects the setting in which they are governed, which means there is a trade-off between how strict the rules are [17]. This exchange is like a give-and-take between the two people.

They look at data from 47 developed and developing countries over nearly 20 years to see if financial stability and bank loan channels exist and how strong they are. This research has been done for almost 20 years. Paul-Olivier Klein and his colleagues used many different methods to do these tests, which were done in full. According to what we found, larger capital amounts make the financial system more stable, help keep bank lending in good shape, and positively affect economic activity in the long run. These effects on real GDP growth are important for businesses, as they can add up to 1.14 percentage points for every percentage point of faster capital growth. In other words, the results could greatly affect how the economy grows. The business will be affected in a big way by this. Our main results hold up well in several tests, supporting that safer banking systems don't slow down the economy [18].

This tool is a way to increase charter value. However, contrary to what Keeley (1990) and Hellman, Murdock, and Stiglitz (2000) say, limiting competition is unnecessary to increase renting income. Gerald P. Dwyer and his colleagues made this tool. They show that capital requirements alone are insufficient to solve the moral hazard problem caused by deposit insurance [19].

Eric Jondeau et al. The fact that savings banks and shadow banks exist simultaneously shows how financial activity can be multiplied and shows a number of the things that make

the banking system unique. Using a large positive risk shock and a large negative investment shock, we show that a crisis like the one in 2008 would cause a bank capital deficiency of between 2.2% and 3% of euro-area GDP, which is about 207.282 billion euros [20]. This number is equal to nearly 207.282 billion euros. They do this by using a large positive risk shock and a large negative investment shock together. This lets them get the results they want.

Yehning Chen et al. The research's results show that financial integration may be bad for financial stability and that the connection of banks is more likely to cause problems when the economy suddenly goes from a boom to a slump. The results also show that when the economy goes from a boom to a slump quickly, the way banks are linked together is more likely to cause trouble. If reducing systemic risk is a top goal for the government, then more benefits should be put in place for banks to reduce how much they are linked to each other [21].

The Chune Young Chung et al. model predicts that when the market crashes, changes in asset prices cause a shift in how the CAPM betas of different assets are distributed. This, in turn, makes all traded assets move in the same direction. The model's predictions are supported by our observations, which were based on data from the stock market in the United States. The study helps us learn more about how asset prices change during major market downturns, like financial disasters [22]. This knowledge can then help people make better choices about investments.

Jonathan Kreamer and a few other people. The amount of cash that financial intermediaries have determines their ability to promise future money. However, they provide liquidity by joining assets that are only partly liquid. When there isn't enough cash on hand, a positive liquidity premium and a low level of investments aren't good for the economy. These things lead to low spending, which doesn't work well. Because banks have lost money, the liquidity premium has increased, making spending less attractive. As a result of my research into the best way for the government to provide liquidity, I concluded that when there isn't enough private liquidity, the government should issue bonds. This is because bonds are liquid, which would justify countercyclical budget deficits. This would be a good reason for budget gaps that work against business cycles [23].

## 3. Proposed Method

### 3.1 Proposed algorithm for data preprocessing

---

Input: Dataset D

Output: Train Set T, Test Set Te

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1. Libraries used : os, scikit-learn, scipy,pandas
2. Notifications:
3. D -dataset
4. T – train set
5. Te – test set
6. i-loop Variable
7. append,t.test,corr,mean -functions from scikit learn
8. load D
9. for i in range(D.shape[0])
10. each row D[i]
11. if D[i].mean()>0.90
12. drop D[i]
13. else
14. if D[i].corr >0.50
15. drop D[i]
16. else
17. if D[i].T_test()>0.02
18. drop D[i]
19. else
20. continue
21. for i in range(D.shape[0])
22. c=c+1
23. if c<=D.shape[0]/2 -1
24. T.append(D[i])
25. else
26. Te.append(D[i])
27. Return T,Te

---

Algorithm 1 splits the dataset into train and test, which begins with loading the dataset D and then iterating over it, during iteration it determines outliers, correlation and T-test to drop the part of the dataset which not follow the statistical properties as statistically not proper data leads to huge impact over the model performance once a statistical test and preprocessing done, the algorithm returns the train and test file.

### 3.2 Proposed algorithm for training

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**Input:** T, Te

**Output:** Trained Model

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1. Libraries: scikit learn, pandas, scipy
2. Notations :
3. T- train
4. Te -Test
5. i-loop variable
6. D- dataset
7. M -Xgboost model
8. L-parameters list
9. Score -list to capture score values
10. classification_score -function from scikit learn

11. Score.Mp – empty list
12. Fs -final Score
13. rate-variable to store regressor results
14. append,parameters,regressor -functions from scikit learn
15. Load T
16. Load M
17. L=[100,150; 3,4,5,6; 0.1,0.5,0.12]
18. M=[]
19. Score=[]
20. For i in range(L);
21. M= M.fit(T,L)
22. Score = Score.append(classification_score(Te, M.predict(Te)))
23. Mp[i]=Mp[i].append(M.paramters)
24. For i in range(len(Score))
25. If Score[i]>Score[i+1]
26. Score[i]=Score[i+1]
27. Else
28. Continue
29. Fs=Score[len(Score)]-1
30. For i in range(len(Score))
31. If Score[i]==Fs
32. Load regressor()
33. rate=Mp[i].regressor()
34. Return Mp[i]

Algorithm 2 trains and return the final trained model as a file; it begins with loading the stock xgboost model from the scikit learn and then, retune it based on the parameters on which a high score is returned by it; also, it analyses the Score produced by the after sorting the results of score list, once highest Score reaches to end parameters, regressor called over the model and model of those saved into the system for further calling.

### 3.3 Proposed architecture

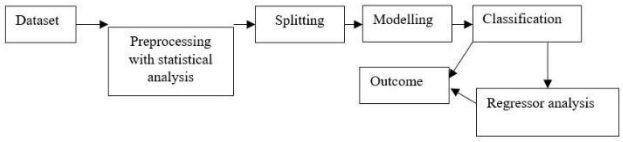


**Fig 1**: Flow of proposed working model.

Figure 1 represents the working flow of the proposed model, which begins with data splitting. After that statistical preprocessing is performed over the dataset, which returns multivariate analysis report for the model. Then preprocessed data set is passed into boosting model, which returns trained on the training dataset. Then the classification results are passed into the regressor to return

the effects in a change in the exchange rate due to an economic crisis.

## 4. Implementation

### 4.1 Hardware and Software

**Specifications:**

- **Processor:** Intel® Core™ i5-1240P 12th Gen (12 MB cache, 12 cores, 16 threads, max 4.40 GHz Turbo speed)
- **Operating System:** Windows 11 Home (English, Single Language version)
- **Graphics:** Intel® Iris® Xe Graphics
- **Display:** 16-inch screen, FHD+ resolution (1920x1200) at 60Hz, Anti-glare, 250 nits brightness, ComfortView with a wide viewing angle. Non-touchscreen.
- **RAM:** 16 GB (2 slots of 8 GB each), DDR4, clocked at 3200 MHz
- **Storage:** 512 GB SSD (M.2, PCIe NVMe)

**Python Libraries:**

- Numpy , Scipy, Scikit-learn, Theano, TensorFlow, Keras, PyTorch, Pandas, Matplotlib

### 4.2 Dataset

#### 4.2.1 Dataset link :

https://www.kaggle.com/datasets/chirin/africa-economic-banking-and-systemic-crisis-data

The dataset concentrates on Banking, Debt, Financial, Inflation, and Systemic Crises that took place between 1860 and 2014 in 13 African nations. These countries are Algeria, Angola, Central African Republic, Ivory Coast, Egypt, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia, Zambia, and Zimbabwe.

#### 4.2.2 Dataset link:

https://www.kaggle.com/datasets/tomasmantero/banks-historical-stock-price

Dataset description: data are taken from stocks of global banking leaders as the crisis shows strong indication into those stocks, data having data points from the following banks:

- Bank of America (BAC)
- CitiGroup (C)
- Goldman Sachs (GS)
- JPMorgan Chase (JPM)
- Morgan Stanley (MS)
- Wells Fargo (WFC)

Data points contain records for 2007, as in 2008 global market crisis happened over the globe, so data points also indicate the banking structure's effects on the economy well.

### 4.3 Analysis of first dataset

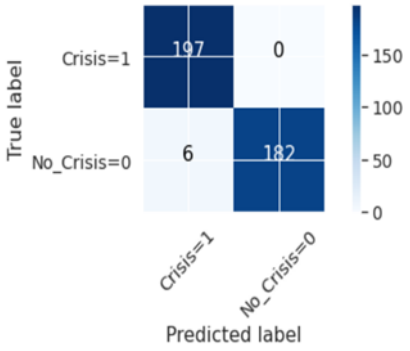


**Fig 2:** Statistical view of different channels of crisis.

Figure 2 represents two different channels which were results of the statistical analysis over the historical dataset, which generates that not only the banking crisis key factor showing the economy of the country but system crisis and currency crisis also key factors to indicated downfall

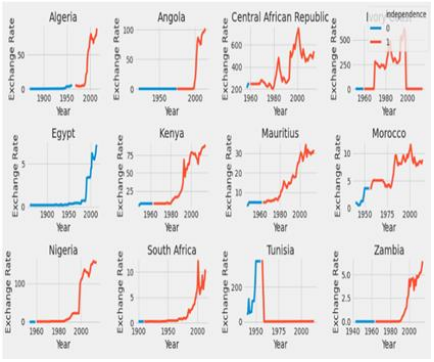


**Fig 3:** Confusion matrix for classification.

Figure 3 represents the confusion matrix for the classification modelling performance analysis. It was observed from the above matrix that both false positive and false negative samples are significantly less in number in this set of experiments.

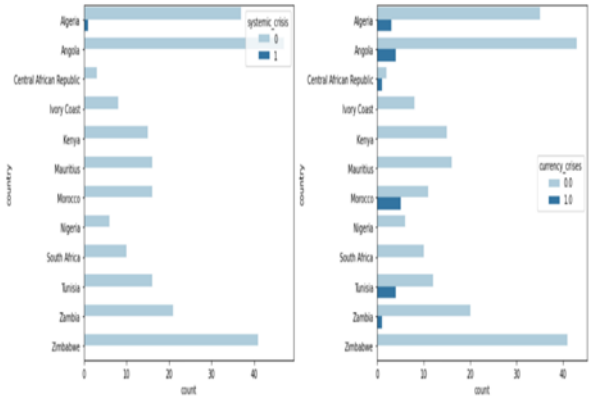


**Fig 4:** Prediction of exchange rate based on results of economic crisis surrounding countries.

Figure 4 represents how rounding countries' exchange rate changes as neighbouring countries suffer from the economic crisis; this is produced by regression analysis over the classification results of the proposed model.

### 4.4 Analysis of the first dataset

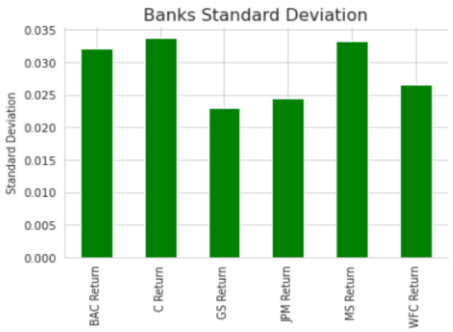


**Fig 5:** Shows the standard deviation of the values of various banks named here in a stable state.

Figure 5 shows the standard deviation of the values of various banks named here in a stable state; it shows that standard deviation values are different before the decline, which seems constant, which indicates market stability in the banking sector, and it was inferred that financial infrastructure is stable which seems that market is also in a stable state.

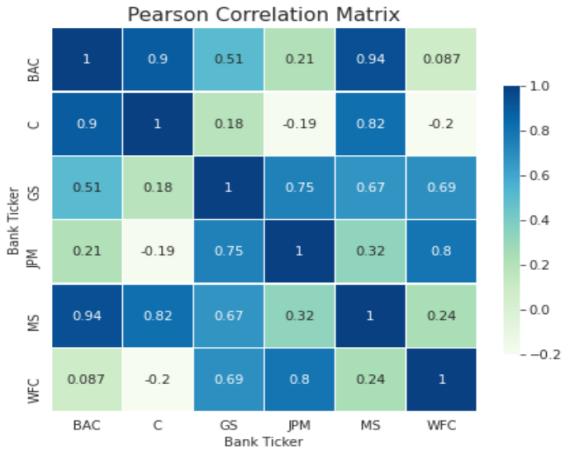


**Fig 6:** Shows Pearson correlation between various international banks shows.

Figure 6 shows the Pearson correlation between various international banks, showing that one bank's values depend upon another and how the market moves. It was observed from the correlation matrix that the highest correlation is between MS and BAC, which is 94%, which means they exhibit a common pattern in the market.

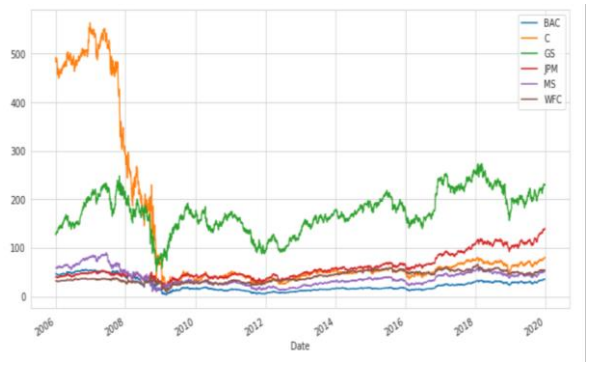


**Fig 7**: Represents the change in values in the market crisis

Figure 7 represents the change in values in a market crisis, or it is better than the rate of change of values when the market starts moving towards a global crisis. It was inferred from the graph that similar patterns in shorter ranges were visible in 2008 and 2020, times when global economic conditions were impacted 2008 by the recession and global financial crisis and 2020 impacted by COVID-19, which gives perspectives that analyzing the banking infrastructure plays a key role in predicting market downfall.

## 5. Result

### 5.1 Result for the first dataset:

**Table 1:** Comparative analysis of **the** first dataset

| Model | Accuracy | Recall | Precision | F1-Score |
|---|---|---|---|---|
| Decision Tree [1] | 78 | 74 | 77 | 75 |
| Logistic regression [2] | 80 | 72 | 78 | 78 |
| Logistic regression with optimization [3] | 82 | 79 | 81 | 80 |
| Naive Baye[4] | 81 | 85 | 80 | 80.4 |
| Random forest [5] | 82 | 81.3 | 80.4 | 81 |
| Proposed | 87 | 90 | 94 | 91 |

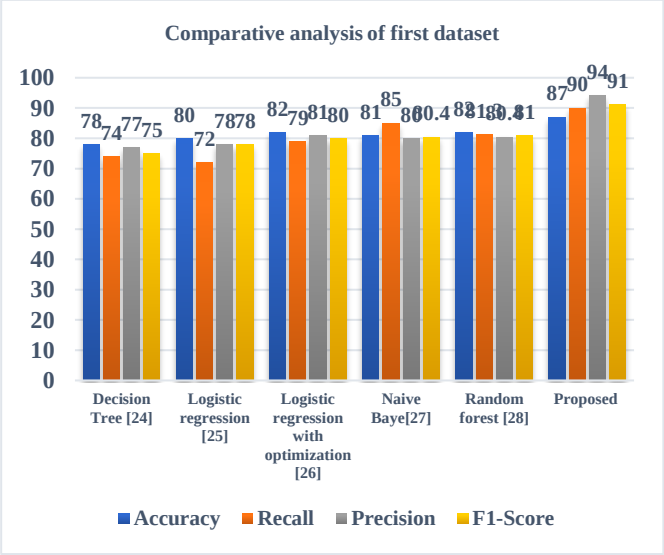


**Fig 8:** Comparative analysis of **the** first dataset.

Tables 2 and figure 8 show a comparative analysis of the proposed model with several existing solutions; it was observed from the results of the proposed model that proposed model outperforms the comparisons as it can handle boundary cases even with outliers and can manage mitigation of overfitting which makes it surpassing over existing solutions.

### 5.2 Result for the second dataset:

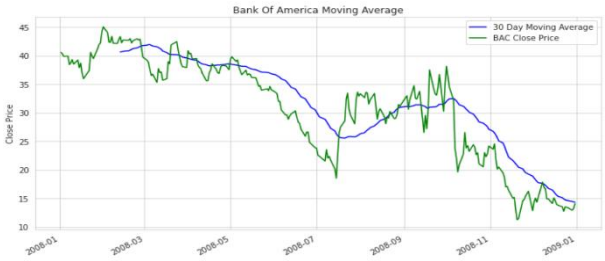


**Fig 9:** The predicted result of bank movement.

Figure 9 shows the predicted movement of the banking sector. It was observed from the graph that as the date of the global market crash declared reached near trends of values started to decline, it declined to its lowest value and hit the lower market circuit, which was true when recalled 2008 market crisis.

**Table 2:** Comparative analysis of the second dataset.

| Model | Accuracy | Recall | Precision | F1-Score |
|---|---|---|---|---|
| Decision Tree [1] | 77 | 71 | 70 | 71 |
| Logistic regression [2] | 78 | 77 | 70 | 74 |

| | | | | |
|---|---|---|---|---|
| Logistic regression with optimization [3] | 81 | 80 | 81.2 | 80 |
| Naive Baye[4] | 83 | 85.1 | 81 | 82 |
| Random forest [5] | 85 | 82 | 85 | 83 |
| Proposed | 89 | 90 | 92 | 92 |

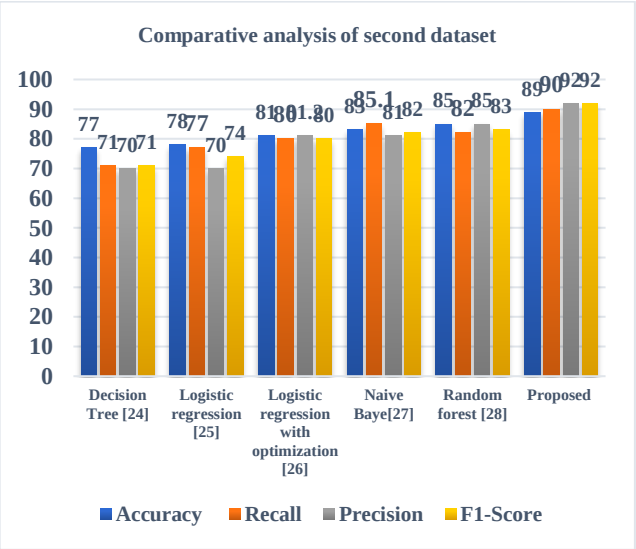


**Fig 10:** Comparative analysis of the second dataset.

Tables 2 and figure 10 show a comparative analysis of the proposed model with several existing solutions; it was observed from the results of the proposed model that proposed model surpasses the comparisons as it able to handle marginal cases even in continuous cases as data is varying as time passes and able to manage overfitting cases which makes it outperforming over existing solutions.

## 6. Conclusion

Studying banking data offers valuable insights for detecting economic downturns, and various countermeasures have been employed by banks in response. By both quantitative and qualitative assessment of banking records, signs of looming economic crises, such as surging non-performing loans or dwindling profits, can be discerned. In facing such crises, banks have opted for strategies like loan portfolio restructuring, bolstering capital reserves, and enhancing risk management protocols. Prompt detection of these economic disruptions and deploying effective strategies is pivotal for ensuring financial stability. In essence, this research underscores the need for consistent oversight of banking information to spot economic challenges early and initiate preventive actions.

### Author contributions

**Geetanjali Sharma [1]**: Conceptualization, Methodology, Software, Field study, Data curation, Writing-Original draft preparation, Software, Validation., Field study **Dr. Shashi Bhushan[2],Dr. Asmita Manna[3], Kavita J. Kolpe[4]**: Visualization, Investigation, Writing-Reviewing and Editing.

### Conflicts of interest

The authors declare no conflicts of interest.

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