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Credit Credit Risk Management Using Hybrid Methodologies

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CREDIT RISK MANAGEMENT

USING HYBRID METHODOLOGIES

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TABLE OF CONTENTS

Sr. No.	Description	Page

ACKNOWLEDGMENT

ABSTRACT:

Federal Home Loan Banks (FHLB) of the United States provide funding solutions and liquidity to the borrowing banks in and outside of the United States of America. This paper focuses on the borrower outside of the United States. The FHLBs heavily rely on popular rating agencies to measure the creditworthiness of the members. Available research suggests that the health of banks from the sovereign is dependent on the credit posture of the sovereign, and it is essential to review the sovereign entities of the borrower banks. All major FHLBs use the credit bureau for the credit assessment. This research questions the reliability of the rating agencies for Credit Risk Management. If credit-related information is not processed correctly or communicated properly within FHLBs, the more likely the bank might face unanticipated loss. It is imperative to measure and use improved credit risk management. This research identifies the potential drawbacks of the traditional credit risk management and points to the importance of hybrid solutions for reliable and residual credit risk solution. The paper also describes two of the prominent credit risk analysis techniques.

Keywords: Credit Risk Management, Sovereign Credit Risk Analysis, Logical Regression, Rating Agencies.

INTRODUCTION:

As part of Curricular Practice Training(CPT), I was fortunate to work with one of the 11 Federal Home Loan Banks (FHLBs) in the United States. While working at FHLB of Des Moines, I was part of a credit risk group that was responsible for identifying, evaluating, controlling, measuring, reporting, and monitoring the risk associated with vendors, counterparties, and members. Part of my work needed me to read and analyze the credit bureau ratings on the borrowers of the FHLBanks. In my opinion, the Economy Intelligence Unit and the Credit Bureau constitutes a significant part of credit measurement. Surprisingly, despite past well-known disasters, a large percentage of organizations follow credit bureaus for credit risk management.

This project attempts to study and understand the risk involved in relying on rating agencies. It is informed by peer-reviewed, unbiased sources. Because Federal Home Loan Bank of Des Moines members need to remain anonymous for confidentiality reasons, this research does not include any names, financial details, or credit ratings that could reveal or describe any active or inactive member's information.

CREDIT RISK MANAGEMENT:

"Credit risk is the potential that a borrower or counterparty will fail to meet its obligations in accordance with agreed terms. Credit risk analysis is a form of analysis performed by a credit analyst to determine a borrower's ability to meet their debt obligations."

- *Federal Housing Finance Agency*

The Federal Housing Finance Agency (FHFA) closely monitors the FHLBanks' underwriting, credit administration, and risk management practices to ensure identification, monitoring, and management of related credit risks. *(fhfa.gov)* Figure 1 below identifies the locations of FHLBs in the United States. FHFA released the Performance and Accountability Review (PAR) for 2019 based on annual regulation examination. The report stated that the Federal Home Loan Banks are facing constant difficulties for many areas. The reviews indicate that the primary cause of continuous banking problems to be directly related to operational risks, which include the lack of credit standards for borrowers and counterparties, poor portfolio risk management, or a lack of attention to changes in economic or other circumstances. FHFA also warned that it could lead to a deterioration in the credit standing of bank counterparties. *(FHFA-Performance and Accountability Review, 2019).*
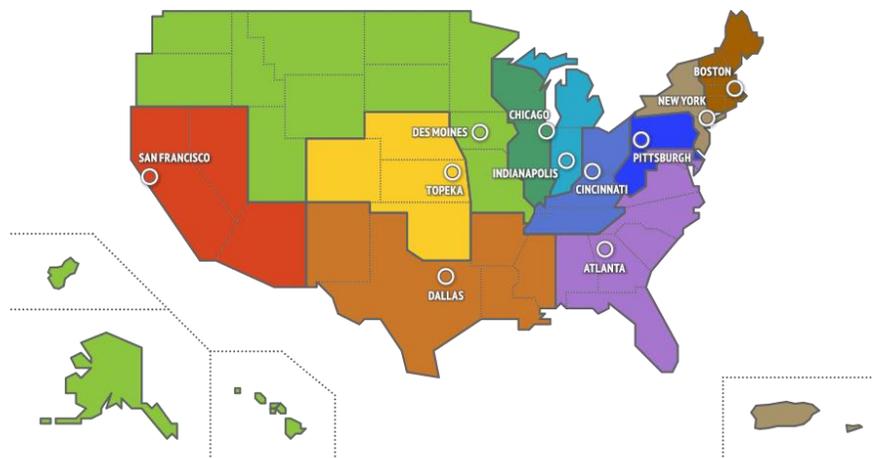

Figure 1: Federal Home Loan Banks in the United States

Each of the FHLBanks does credit risk management to address all the issues stated in the PAR review. Based on the Federal Housing Finance Agency guidelines, credit risk management practices may differ among the regulated entities because of the nature of their respective credit

activities. However, a comprehensive risk management program should cover the following four areas: (i) establishing an appropriate credit risk environment; (ii) operating under a sound credit-granting process; (iii) maintaining a fair credit administration, measurement, and monitoring process; and (iv) ensuring adequate controls over credit risk. *("Risk Management Module," fhfa.gov)*

The goal of credit risk management is to keep the residual risk low while maximizing a bank's risk-adjusted rate of return. Banks should also be concerned about the relationships between credit risk and other risks. Credit is one of the primary sources of income for FHLBanks, and credit risk management is directly or indirectly dependent on the Operational, Model, Market, and Collateral risk of the system. Failing one of the areas might pose a threat to other areas of the Federal Home Loan Bank.

The successful management of credit risk is a critical component of a comprehensive method for risk management and the long-term success of any banking system. Besides, the continued reduction in the retained portfolios, as well as initiatives such as credit risk transfer transactions, could reduce revenue and increase the likelihood of future losses. *(Mellios, Paget-Blanc (2006))*

This paper attempts to showcase the current approach used by major Federal Home Loan Banks following its with its areas of improvement. The article also proposes a hybrid methodology combining traditional and modern approaches for credit risk management.

LITERATURE REVIEW:

The purpose of this literature review is to showcase the present credit risk management methodologies and scoring systems used by Federal Home Loan Banks, which helps to determine whether a borrowing member or counterparty can be granted a loan or not. Traditionally, FHLBs rate the financial organizations based on opinions or outlooks published by credit bureaus such as Moody's, S&P, and Fitch. Every Federal Home Loan Bank follows a comprehensive guide for credit risk analysis provided by risk professionals and approved by the Federal Housing Finance Agency. The credit risk analyst reviews each active sovereign country annually and compile the detailed document to examine the health of the borrower financial institutes. Figure 2 identifies the possible credit risk group structure at the Federal Home Loan Bank. In this paper, I emphasize on the counterparty group, prominently, sovereign countries and their banks.
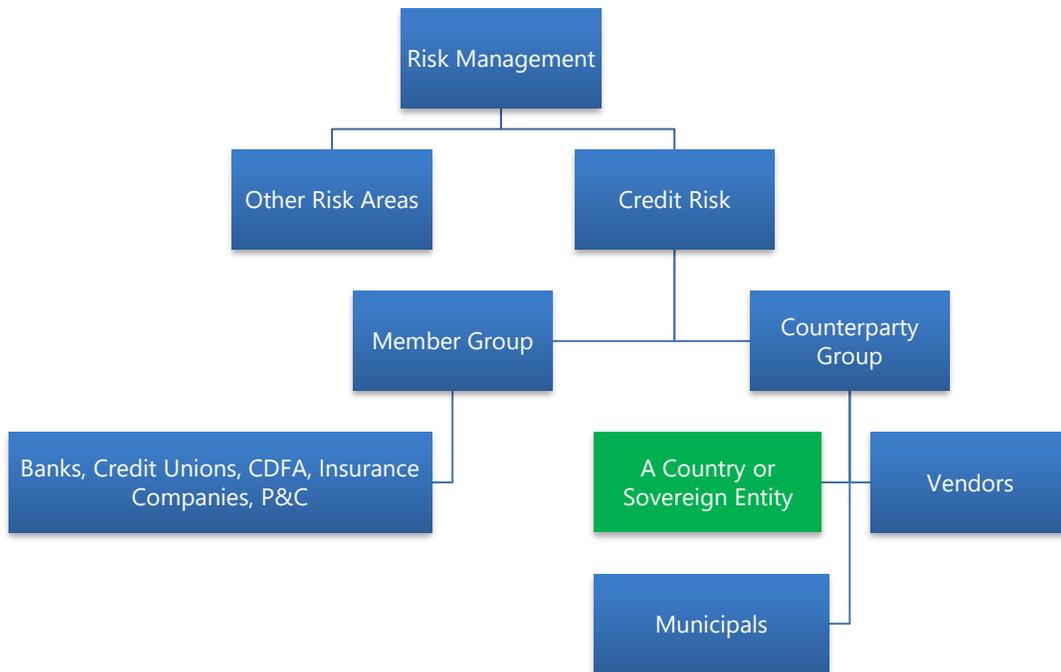

Figure 2: Credit Risk Group Structure at Federal Home Loan Bank

Purpose of Sovereign Reviews –

"A sovereign credit rating is an independent assessment of the creditworthiness of a country or sovereign entity. Sovereign credit ratings can give investors insights into the level of risk associated with investing in the debt of a particular country, including any political risk."

- *Federal Home Loan Bank of Des Moines*

Sovereign finance crises have significant effects on economic activity *(Furceri and Zdzienicka, 2011).* The impact of sovereign rating revisions on the activity of European banks, in terms of their regulatory capital ratio, profitability, liquidity, and lending supply. It is also verified that a sovereign downgrade has a significant impact, primarily on capital ratios and lending supply. The effect becomes substantial when problems in the banking sector accompany sovereign stress. *(DePaoli et al., 2009)*

As documented by *Reinhart and Rogoff (2011),* banking crises are repeatedly followed by or concurrent to sovereign debt crises. Banks lie at the heart of the payments system, so a downturn in this sector can readily spread through the rest of the economy, with far-reaching consequences for both the private and public sectors. As a result, governments have powerful incentives to avoid disruptions in the banking system. The recent European crisis offers the latest evidence as to the large extent to which governments may go to rescue their banks, making it clear that financial sector problems tend to become fiscal sector problems. In that way, banking crises commonly set the stage for sovereign debt crises. (*Reinhart and Rogoff, 2011).*

Banking crisis episodes similar to Ireland in 2008 and Spain in 2012 show how the liquidity and solvency troubles of the banking sector can radically turn into a fiscal burden sufficiently large to lead into a sovereign debt crisis that requires external assistance for its containment. The

sovereign's outlook can assist in a better understanding of the financial institutions. FHLBanks analyze the sovereign intending to check banks' affluence on exposure. *(Voloshyn, 2020).*

The Structure of the Rating Market –

The rating market comprises ten firms currently registered as NRSROs (Nationally Recognized Statistical Rating Organizations) by the US Securities and Exchange Commission (SEC). The rating is dominated by the Big Three: Standard & Poor's, Moody's, and Fitch, with a combined market share above 90%. *(Bloomberg.com)*

Moody's –

Moody's Investors Service provides investors with credit ratings, risk analysis, and research for stocks, bonds, and government entities. Investors such as FHLBs use these ratings as limits on their investment parameters and as means for expanding their investment horizons to markets or security types they do not cover by their own analysis. Moody's rating scale, running from a high of Aaa to a low of C, comprises 21 notches. It is divided into two sections: investment grade and speculative-grade. *(moodysanalytics.com)*

Figure 3 below provides detail for the investment and speculative-grade Ratings.

INVESTMENT GRADE
- » **Aaa** – highest rating, representing minimum credit risk
- » **Aa1, Aa2, Aa3** – high-grade
- » **A1, A2, A3** – upper-medium grade
- » **Baa1, Baa2, Baa3** – medium grade

SPECULATIVE GRADE
- » **Ba1, Ba2, Ba3** – speculative elements
- » **B1, B2, B3** – subject to high credit risk
- » **Caa1, Caa2, Caa3** – bonds of poor standing
- » **Ca** – highly speculative, or near default
- » **C** – lowest rating, bonds typically in default, little prospect for recovery of principal or interest

Source: Moody's Investor Service
Figure 3: Moody's Credit Risk Ratings

Standard & Poor's (S&P) –

Standard & Poor's (S&P) is a leading index provider and data source of independent credit ratings. It is also the provider of the popular S&P 500 Index as well as several other global market indices. It covers multiple industries, benchmarks, asset classes, and geographies. It issues credit ratings on public and private company debt, as well as governments. These range in scale from AAA to D. The company has more than 1,400 credit analysts and has issued more than 1.2 million credit ratings on governments, corporations, the financial sector, and securities. *(spglobal.com)*

Fitch –

Fitch Ratings Inc. is a more than 100-year-old American credit rating agency. It is one of the three nationally recognized statistical rating organizations (NRSRO) designated by the US Securities and Exchange Commission in 1975. Fitch Ratings' long-term credit ratings are assigned on an alphabetic scale from 'AAA' to 'D.' *(fitchratings.com)*

FHFA ratings –

While determining a borrower's ability to meet FHLBs debt obligations, FHLBs compile the review based on the credit ratings provided by credit bureaus. FHLBs consider the lowest of the ratings to assign the internal credit score to determine the banks' health. The credit score can range from FHFA_1 being the highest and FHFA_7 being the lowest. FHLB has maintained the standard threshold to provide the debt to entities with an FHFA rating of FHFA_4 or above. *(fhfa.gov, 2020)*

In my opinion, credit agencies with their distinct credit rating structures are confusing and could create difficulty drawing conclusions. Additionally, the outlooks – Stable, Positive, and Negative– used with the ratings could add additional uncertainty to the credit profiles.

RESEARCH QUESTION:

Understanding how credit is issued to different entities is key to offering sustainable solutions. The past well-known disasters due to misinformation from credit bureaus have questioned the infrastructure for credit risk management. This research seeks to address credit risk management issues through the following question:

Why is it risky to rely on credit bureaus for the sovereign credit risk ratings entirely?

The credit bureaus have a tremendous power through data, and analytics have been in the spotlight for generating the biased, misjudged, and even incorrect credit analytics for several decades. The three big RAs are regarded as all-powerful, mysterious, ignorant, corrupt, and unregulated. Furthermore, the numerous researchers, observers, journalists from the yellow-press to trade journals, politicians, and even economists feel absolutely confident that the rating agencies (RAs) bear a formidable responsibility for boosting the financial problems of several countries into liquidity and even solvency crises. *(Tichy, 2011)*.

In times of financial plenty, credit ratings go mostly unnoticed. In downturns, though, they attract more scrutiny—and are often found wanting. The dotcom crash of 2000-01 exposed ratings of some erstwhile corporate stars, including Enron and others as unwise. Worse was to come in the financial crisis of 2007-09, which the three big rating agencies—Moody's, S&P, and Fitch— helped cause by a trading reputation for profit and giving implausibly high marks to securitized mortgages. An official report on the crisis branded the agencies "essential cogs in the wheel of financial destruction. *(economist.com, "Credit-rating agencies are back under the spotlight," May 2020)*

It is, then, no surprise that the ratings oligopoly faces another potential backlash, now that an even bigger pile of debt threatens to go sour, thanks to COVID-19. Eyebrows have been raised as the agencies have rushed to markdown bonds and loans of all types. As of May 2020, all the credit bureaus have downgraded the highest number of banks and sovereigns in recent memory. Considering the past records, it would be unwise to entirely rely on the rating agencies by putting all eggs in the same basket. *(snpglobal.com, "How COVID-19 is affecting the banks' ratings", 2020).*

Money center banks assess the creditworthiness of trading counterparties (including money center banks). Counterparty Credit Risk (CCR) is a big muddle while measuring and decision making on creditworthiness and banks turn to Credit Bureaus for the counterparty related information. Considering the modern risk management strategy, the dependency on a single source of information would be a high-risk methodology. *(bis.org, "BASEL Framework - Counterparty Credit Risk Review," Effective as of 01 Jan 2022 and last updated on 15 Dec 2019)*

Problem with the traditional approach –

According to the Economist Intelligence Unit (EIU), loans are the largest and most obvious source of credit risk for FHLBanks. In my opinion, the banks are increasingly facing credit risk (or counterparty risk) in various financial instruments other than loans, including acceptances, interbank transactions, trade financing, foreign exchange transactions, financial futures, swaps, bonds, equities, options, and in the extension of commitments and guarantees, and the settlement of transactions. It is easier to utilize the information available with the borrower banks than relying on the rating provided by credit bureaus who refer a few of the instruments to yield ratings. *(Economist Intelligence Unit, 2020)*

Below are some of the problems with traditional credit risk management methodology.

1. **Lack of Reliability.** The 2008 financial crisis identified several problems with reliability. Moody's, Standard & Poor's (S&P), and Fitch have all been heavily criticized for their role in the financial market crisis of 2008. Much of the criticism centers around the AAA ratings that were given to mortgage-backed securities that in many cases were comprised of subprime loans. The ratings agencies' highly complex models failed to consider the possibility of a broad nationwide decline in housing prices and how that would impact the performance of the bonds. In 2007, as housing prices began a widespread decline, Moody's downgraded 83% of the mortgage securities that had been rated AAA just one year earlier. Some observers have blamed the prevalence of a system in which a bond's issuers pay the ratings company for their work for inflated ratings. Moody's competitor S&P paid $1.5 billion to the Justice Department, 19 states, and the District of Columbia to resolve allegations that it knowingly misled investors. Moody's was criticized by many European countries for aggressive sovereign credit rating downgrades during the crisis, at a time when the US government rating remained AAA despite budgetary problems. *(Matt Krantz, "2008 crisis still hangs over credit-rating firms", 2013, USAToday.com)*

2. **No universal risk modeling framework.** Each credit agency has its credit rating scale. Considering the involvement of additional outlooks with the ratings – Positive, Stable, Negative– makes it not only complicated but also creates uncertainty in credit risk judgment. Figure 4 below shows the different credit ratings among Moody's, Standard & Poor's (S&P), and Fitch.

Moody's	S&P	Fitch	equivalent	Appraisal
Aaa	AAA	AAA	20	highest quality, smallest risk
Aa1	AA+	AA+	19	high quality, very low credit
Aa2	AA	AA	18	
Aa3	AA-	AA-	17	
A1	A+	A+	16	upper-medium grade, low credit risk
A2	A	A	15	
A3	A-	A-	14	
Baa1	BBB+	BBB+	13	moderate credit risk
Baa2	BBB	BBB	12	
Baa3	BBB-	BBB-	11	
Ba1	BB+	BB+	10	questionable credit quality
Ba2	BB	BB	9	
Ba3	BB-	BB-	8	
B1	B+	B+	7	high credit risk, generally poor credit quality
B2	B	B	6	
B3	B-	B-	5	
Caa1	CCC+	CCC	4	very high credit risk, extremely poor credit quality
Caa2	CCC	CCC	3	
Caa3	CCC-	CCC	2	
Ca	CC	CCC	1	highly speculative, potential recovery value low
D	D		0	

Source: (Tichy, 2011) "Credit rating agencies: Part of the solution or part of the problem?"

Figure 4: Top three Credit Bureau with Credit Rating Ranges

3. **Not prepared for unprecedented situations.** Manmade disasters (war, disease spread, cyber-attack, financial fraud, etc.), natural disasters (earthquake, tornados, wildfires, etc.), or other scenarios such as elections and trade relations may require to review the credit health of the sovereign unexpectedly. Considering the review generation duration, it might cause a delay in receiving the updated review from the credit agency before analyzing the situation.

Clearly, there are lots of factors negatively influencing traditional credit risk models. The complete reliance on rating agencies can be reduced through the in-house analysis for credit risk management. Alternatively, partial dependency can assist in verifying the aligned in-house modeling results produced from the humongous amount of the database from credit bureaus.

HYBRID CREDIT RISK MANAGEMENT

The persistence of the criticism seems to indicate that there should be cross-checked while dealing with credit risk assessment. Federal Home Loan Banks must have an internal credit rating methodology with a combination of rating agency opinions for credit risk analysis of sovereign entity. According to experts, it may be a waste of time and money for the FHLBs to expend considerable resources to measure bank risk. In my opinion, the creation of an internal rating system would go a long way beyond sovereigns serving credit risk management for local borrowers as community banks and insurance companies.

On the positive note, banks have a sufficient, if not more than necessary, the amount of data for the credit risk analytics to drive a traditional risk evaluation. This research proposes an alternative to the traditional approach that can be used for sovereign credit risk management. The successful model building would generate the rating and can be compared to the credit bureau to derive the conclusion on the creditworthiness of the entities. In the case of rating disputes, credit risk officers and managers can get alerts to follow the sound practices suggested by the Federal Housing Finance Agency. The proposed hybrid solution not only verifies the credit bureau ratings but also provides real-time data analysis at any point in time.

The key to build a reliable risk prediction model – and ensuring that appropriate comprehension could reflect the risk profile – is to implement an integrated, quantitative credit risk solution.

This solution should get banks up and running quickly with simple portfolio measures. It should also accommodate a path to more sophisticated credit risk management measures as needs evolve. Figure 5 highlights the process below.
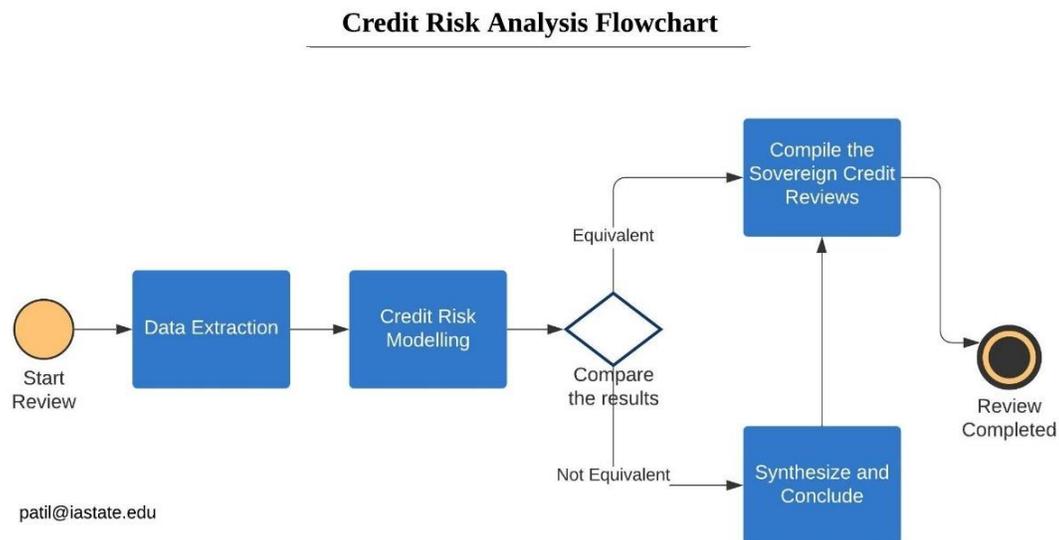
Credit Risk Analysis Flowchart

Figure 5: The flowchart for the proposed solution.

The credit bureau's problem with multiple instrument involvement in credit risk management can be tackled by utilizing the existing data from the borrower bank. The required credit risk management and insight generation start with the first step – data extraction.

1. Data Extraction – Data analytics has developed rapidly in a relatively short period. It can aid in operational aspects and heavily influence decisions in many domains. However, to get the best results, it is essential to choose, improve, and effectively manage both publicly available and existing data with the bank. Analysts have the following data to use for model building:

- Financial statements – (An income statement, a statement of changes in equity, a balance sheet, a statement of cash flows, and notes to financial statements.)

- Publicly available data (annual reports)

- Prospectuses, offering circulars, offering memoranda, trust deeds, or indentures of securities.

- Market data, e.g., stock price trends, trading volume, data on bond price spreads.

- Economic data from industry groups, associations, or bodies, such as the World Bank.

- Discussions with expert sources in industry, government, or academia.

- Data from communications with the debt issuer. If the data are confidential, analysts should strictly observe this by following the compliance.

2. Credit risk modeling – Internal credit analysis using the model will be responsible for answering two questions:

   - The probability of the banks from the sovereign defaulting on the loan.

   - The impact on the financials of the Federal Home Loan Bank if this Default occurs.

   There are several macroeconomic factors to consider while determining the sovereign credit risk. The Basel Committee on Banking Supervision (BCBS) is an international organization that seeks to harmonize risk measurement on banks across the globe. The regulators of community banks (Federal Reserve and the FDIC) and BCBS for international capital standards have developed liquidity measures are the core of the internal credit risk assessment.

The components below measure the financial health of the sovereigns and consequences of 'Default' for both the sovereign and the Federal Home Loan Banks:

- **Probability of Default (PD).** Probability of Default identifies the likelihood that a sovereign bank will default on debt over a loan period. The point-in-time PD will provide real-time results to the analysis. In simple words, it returns the expected probability of customers fails to repay the loan for the current situation. Probability is expressed in the form of a percentage, with a range that lies between 0% and 100%—higher the probability, higher the chance of Default.

- **Exposure at Default (EAD).** Exposure at Default is the outstanding amount borrower banks would pay in the case of Default.

- **Loss given Default (LGD).** Loss given Default is the unsecured outstanding amount that Federal Home Loan Bank expects to lose. It is a proportion of the total exposure when a borrower defaults, calculated by (1 - Recovery Rate).

- **Effective Maturity (M).** The expected loss is calculated by (PD * LGD * EAD).

The below example illustrates these principles applied in a possible scenario.

Norwegian bank takes a $100 M loan (Exposure) from the Federal Home Loan Bank of Chicago. At the time of Default, the loan has an outstanding balance of $70 M. Bank foreclosed bank securities and sold it for $56 M. EAD is $70 M. LGD is calculated by dividing ($70 M- $56 M)/$70 M = 20%.

Probability of Default = 3%

Exposure at Default = $14 M

Loss Given Default = 20%

Expected Loss = $84,000

CREDIT RISK MODEL DEVELOPMENT:

Credit risk modeling collects the information at the first stage and separates the data into categories, as shown in the below table. An independent and dependent variable works as cause and effect. An independent variable is a cause and dependent variable as the effect. In the experiment, we can manipulate the independent variable to measure the dependent variable.

Independent Variables (X)	Dependent Variable (Y)
• Banking System of the Sovereign • Political Stability • Election Watch • International Relations • Policy Trends • Economic Growth • Inflation • Exchange Rates • External Sector • Unemployment Rate	Point-in-Time Probability of Default (PD)

Table 1: Model Variables for Statistical Model Building

Logistic Regression

Logistic regression is the most widely used technique for the estimation of PD. Logistic regression has been one of the practical techniques used in predicting personal loan borrower credit scores. Logistic regression aims to model the probability of an event (*Probability of Default*) occurring depending on the values of independent variables (*Existing and publicly available data*). Logistic regression is a classification algorithm that predicts a binary outcome (1 / 0, *Default / No Default*) given a set of independent variables. It foretells the probability of occurrence of a default by fitting data to a logit function *(Bennell, 2005).*

The Link Logit Function:

A straightforward and standard link function is the mean of the response variable Y that we use as the response instead of Y itself. The logit of Y is used as the response to the regression equation instead of just Y:

$$Ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$$

The logit function is the natural log of the odds that Y equals one of the categories. For mathematical simplicity and our credit risk check, we will assume that Y has only two categories and code them as 0 and 1. The logit function is the inverse of the logistic transform. When the function's variable represents a probability p, the logit function gives the log-odds or the logarithm of the odds $p/(1-p)$. The log-odds score is typically the basis of the credit score used by banks and credit bureaus to rank the borrowers. P is defined as the probability that Y=1 (Representing Default).

Example –

All Xs could be specific risk factors, like independent variables listed above, and P would be the probability that a borrower defaults. β_0 is an intercept, and ($\beta_1 \ldots \beta_k$) is a vector of coefficients, one for each predictor variable.

Random Forest

Random forests combine decision tree predictors, such that each tree depends on the values of a random vector sampled independently and with the same distribution. A decision tree is the most basic unit of the random forest. In a decision tree, an input is entered at the top, and, as it traverses down the tree, the data is bucketed into smaller subsets. In the example shown in Figure 6, the tree determines the probability of Default based on three variables:

Exposure, Unemployment Rates, and Inflation Rate, and the ratio of current exposure to assets. Box 1 contains the initial 100% of the dataset in which 40% of the borrowers are defaulters, and 60% are non-defaulters. Its orange color indicates a higher default risk, whereas the blue color indicates lower default risk. The random forest approach combines the predictions of many trees, and the final decision is based on the average of the output of the underlying independent decision trees.
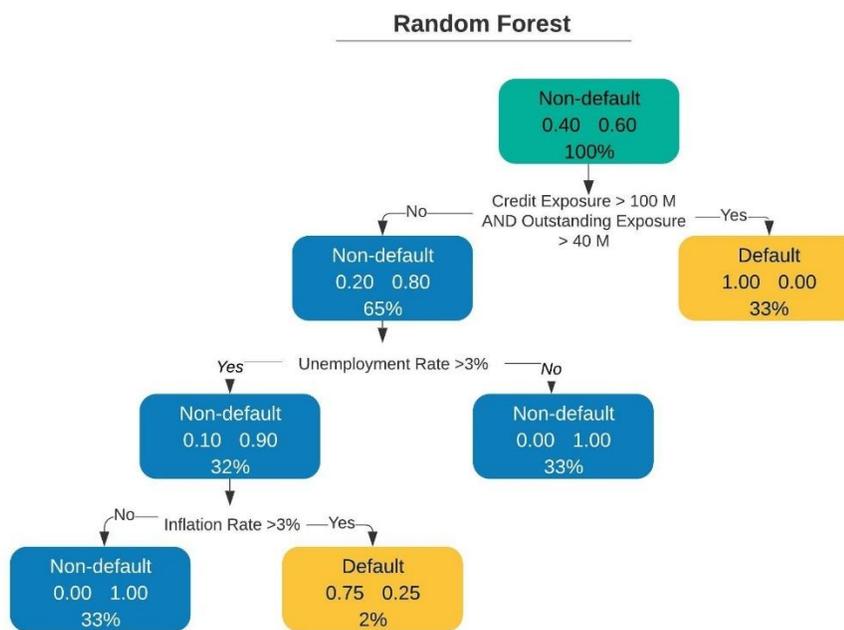

Figure 6: Random forest implementation with four independent variables

In addition to the above two methodologies, listed below are some of the prominent credit risk modeling techniques:

- Gradient Boosting

- Survival Analysis is generally used to compute lifetime PD.

- Neural Network

- Markov chain Modeling

The credit risk analysts measured the performance of each model by accuracy ratio for a period of one year. The proposed solution can be build based on one or more modeling methods. Table 2 shows the comparison among the popular credit risk modeling methods with performance with and without behavioral data in combination with financial data.

Credit Risk Modelling Methods	Financial Information Only	Financial + Behavioral
Random Forest	58.9%	66.5%
Boosting	59.1%	67.5%
Neural Network	56.6%	66.4%

Table 2: Credit Risk Modelling Techniques with Their Performance

Tools and Technologies for Credit Risk Model Development

SAS is a widely used command-driven software package for statistical analysis and data visualization. Alternatively, R and Python are a few of the other options used by financial institutions. These scripting languages provide built-in libraries or repositories for credit risk projects.

3. Examine the results – It is crucial to interpret the results produced by the analytical model and compare it with rating agency ratings. This stage of the credit risk analysis will go in one of two directions. If the internal credit risk analysis outcome matches with rating agencies, the next step is to compile the review to decide the creditworthiness. It is possible that the internal credit rating defers the credit bureau, and then human intervention is required to judge the results.

4. Synthesize and Conclude – It is also called a judgment strategy. The outcome of this step relies on the knowledge of experienced credit professionals. Credit risk analysts derive the results

based on five Cs of the sovereign entities and the banks from the sovereign. (Corporate Finance Institute)

- Character: Check the credit history of the borrower bank.

- Capital: Calculate the difference between the borrower's assets and liabilities.

- Collateral: Value of the collateral (security) provided if the borrower bank fails to repay.

- Capacity: Assess borrower's ability to pay the principal plus interest amount.

- Conditions: Internal (political stability, unemployment rate) and external factors (e.g., economic recession, trade relations, war, natural calamities, etc.)

Based on my experience with credit risk analysis, below are some of the prominent factors to consider while synthesizing and judging the sovereign credit rating.
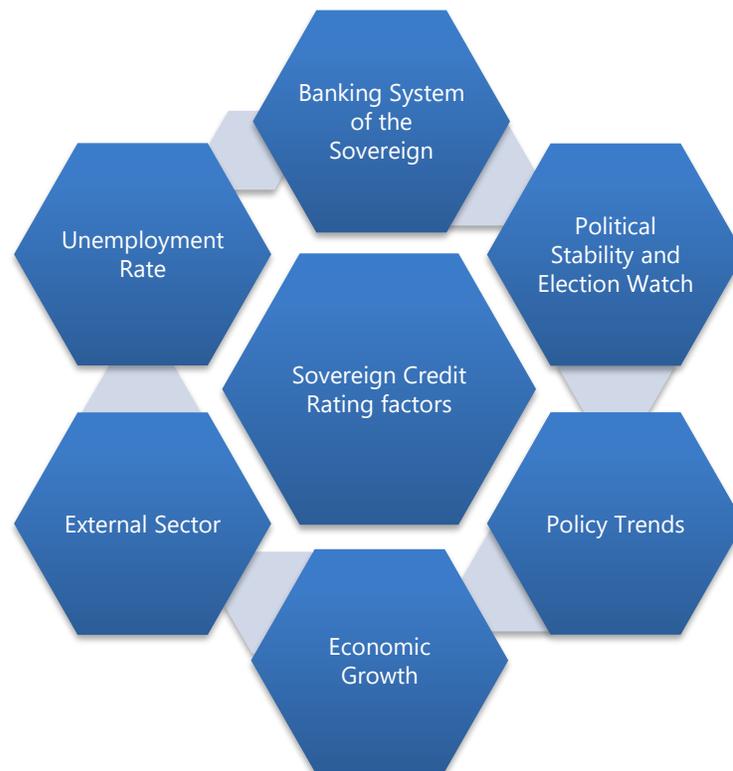

Figure 7: Significant factors that affect the Sovereign Credit Ratings

5. Compile the review – The last step to document the assets and liabilities with a comprehensive understanding of the credit risk of the sovereign entity. If the credit risk is higher the threshold, the Federal Home Loan Bank will either charge a higher interest or forego the lending opportunity altogether. For example, a borrower bank with a superior credit history, diverse economic conditions, and stable global assets will be charged a lower interest rate for the same loan than a weak credit profile bank from the sovereign. The credit risk review can be shared with all the groups within the Federal Home Loan Banks such as Treasury, Accounting, and Auditing.

Advantages of the proposed approach –

1. Data management. An ability to access the right data when it is needed will avoid problematic delays. Readily available financial details related to the sovereign entity can make an efficient credit analysis.

2. Better model management that can provide precise and direct control over both expected and unexpected credit losses.

3. The in-house analysis model will not only provide a real-time credit risk analysis but also enable continuous monitoring for unprecedented situations with robust stress-testing capabilities.

4. Data visualization capabilities and business intelligence tools that get important information into the hands of those who need it whenever analysts need it.

Challenges of proposed approach –

1. Compliance Management– FHFA is responsible for ensuring that the Federal Home Loan Banks operate in a financially safe and sound fashion and operate in a manner consistent with their housing finance mission and protocols. Additionally, Federal Home Loan Banks

must comply with various standards such as SOX (Sarbanes-Oxley Act) and FISMA (Federal Information Security Management Act).

2. Continuous Monitoring and Maintenance – The popular rating agencies have an army for analysts and domain experts for credit risk analysis. For successful credit risk modeling, Federal Home Loan Banks needs to invest in skilled labor and data analytics infrastructure.

CONCLUSION REMARKS AND FUTURE RESEARCH:

Federal Home Loan Banks use sovereign credit ratings to assess the riskiness of a particular country's bonds. The process of credit risk management involves the traditional approach and reliance on rating agencies. The hybrid model proposed through this paper can assess the sovereign credit rating as an independent assessment of the creditworthiness of a country or sovereign entity. The internal credit analysis provides numerous benefits as well as challenges. However, considering all prominent elements of the hybrid credit analysis in place, it would open a window for verified and reliable credit risk management. This research has a scope for improvement and challenges to overcome in the future. The present study can be enhanced, starting from the below research question.

Is credit risk analysis regionally biased?

All three popular credit agencies are under the microscope for rating the sovereign based on region, reputation, or social influence or economic impact. In future research, it is essential to test the hypothesis on the balanced and significant size of the data for sovereign credit analysis. Numerous researchers have pointed available data or global control of the country or continent can for the inclined results from the analytical model. The research should emphasize on understanding the hypothesis of biased credit ratings and finding new insights by validating the statistical algorithms on real-time data.

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APPENDIX:

Abbreviations and Terminologies –

- FHFA – An independent regulatory agency that oversees vital components of the secondary mortgage market, including Fannie Mae, Freddie Mac, and the Federal Home Loan Banks. FHFA works to keep them, and the overall housing finance system, healthy.

- FHLB/The Bank – The Federal Home Loan Banks are 11 US government-sponsored banks that provide reliable liquidity to member financial institutions to support housing finance and community investment. With their members, the FHLBanks represents the largest collective source credit in and outside of the United States.

- Rating Agencies/RAs / Credit Bureaus – Credit rating agencies provide investors with information about whether bond and debt instrument issuers can meet their obligations. Agencies also provide information about countries' sovereign debt. The global credit rating industry is highly concentrated, with three agencies: Moody's, Standard & Poor's and Fitch.

- FDIC – The Federal Deposit Insurance Corporation is one of two agencies that provide deposit insurance to depositors in US depository institutions, the other being the National Credit Union Administration, which regulates and insures credit unions.

- Fannie Mae – Fannie Mae serves American citizens. Fannie Mae is the leading source of financing for mortgage lenders, providing access to affordable mortgage financing.

- Freddie Mac – Freddie Mac makes homeownership and rental housing more accessible and affordable. Freddie Mac operates in the secondary mortgage market to keep mortgage capital

flowing by purchasing mortgage loans from lenders so they, in turn, can provide more loans to qualified borrowers.

- SEC: Credit Rating Agencies – NRSROs (http://www.sec.gov/answers/nrsro.htm). Under the Credit Rating Agency Reform Act, an NRSRO registered concerning up to five classes of credit ratings: (1) financial institutions, brokers or dealers; (2) insurance companies; (3) corporate issuers; (4) issuers of asset-backed securities; and (5) issuers of government securities, municipal securities or securities issued by a foreign government.

- FISMA – The Federal Information Security Management Act of 2002 is a United States federal law enacted in 2002 as Title III of the E-Government Act of 2002. The act recognized the importance of information security to the economic and national security interests of the United States. *(Wikipedia)*

- SOX – In 2002, the United States Congress passed the Sarbanes-Oxley Act (SOX) to protect shareholders and the general public from accounting errors and fraudulent practices in enterprises and to improve the accuracy of corporate disclosures. The act sets deadlines for compliance and publishes rules on requirements. *(digitalguardian.com)*

- Basel Committee on Banking Supervision (BSBS) – The Basel Committee on Banking Supervision (BCBS) is the primary global standard setter for the prudential regulation of banks and provides a forum for regular cooperation on banking supervisory matters. Its 45 members comprise central banks and bank supervisors from 28 jurisdictions.