GROUP WORK PROJECT # _1__
GROUP NUMBER: _____4801_____

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Statement of integrity: By typing the names of all group members in the text boxes below, you confirm that the assignment submitted is original work produced by the group (excluding any non-contributing members identified with an "X" above).	
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N/A

Step 1: Fallout Risk

	Model Failures	Financial Crises
Money at a fixed rate for an unsecured purchase	**Inaccurate loan evaluation**: as time changes, established loan models may no longer work due to changes in the real world e.g. average income increase, and spending pattern change. **Lack of diversification**: lending to the same risk group may break the risk assumptions in the model, leading to higher losses than expected.	**Employment market downturn:** during a market downturn, employment and salary may go down as well. This reduces the repayment ability.
Money at a floating rate for a secured purchase	**Inaccurate loan evaluation**: beyond an unsecured loan, a secured loan e.g. mortgage usually spans a longer term and higher value. It is more challenging to make the model work for an even longer time period. **Lack of diversification**: A lack of diversification in collaterals (e.g. commercial vs residential, different locations, different value groups) would easily lead to a reduction in collateral value in a similar trend.	**Employment market downturn** **Property market downturn:** during a property market downturn or even crisis, the collateral value would decrease significantly thus increasing the chance of collateral value below loan value, increasing the default rate.
Money at a fixed rate for a business for a construction loan	**Inaccurate loan evaluation:** A number of reasons, including insufficient data, erroneous assumptions, or unforeseen market fluctuations, can cause the models that lenders use to evaluate risk and set interest rates to malfunction. This may cause the project risk to be underestimated, which could result in default and losses for the lender. On the other hand, companies might experience unanticipated rises in interest rates or loan denials. **Market fluctuations:** The fixed rate may not cover the entire cost of the project if construction costs rise sharply as a result of labor shortages, material shortages, or unanticipated	**Credit markets tightening:** Lenders may become more risk-averse during financial crises, which makes it harder for businesses to obtain loans, particularly fixed interest-bearing loans, as these are viewed as riskier by lenders. This may impede building initiatives and restrict company expansion. **Increasing interest rates:** In an effort to combat inflation, central banks frequently increase interest rates during recessions. For companies with fixed-rate loans, this can dramatically raise borrowing costs, lowering their profit margins and possibly

	circumstances. This may cause the company to overspend and struggle to make debt repayments, which could put it in financial jeopardy.	endangering the project's viability. **Economic recession:** Financial crises have the potential to trigger, which in turn may impact the demand for construction projects. This may result in lower revenue for businesses, which would make debt repayment more challenging.
Publicly traded Equity	**Leverage:** As we are lending a publicly traded equity, we should be careful about the uncertainties of leverages which can increase gains and losses. **Liquidity:** We must also consider lending the security with good liquidity otherwise illiquid security has a high chance of slippage which can lead to losses.	**Sudden stop Crises:** Stop in capital inflows in markets, the decline in production and consumption, as well as correction in asset prices, can lead to losses or have a drastic effect on lending.
Publicly traded bond	**Leverage:** As we are lending Publicly traded bonds, we should be careful about this security and also about the uncertainties of gains and losses due to leverage. **Non-Linearity:** Bonds have a non-linear return which means it has a non-linear price-to-yield relationship and a non-linear relationship with interest rate and with leverage it can become very risky.	**Debt Crises:** As we are dealing in bonds, we should be careful about debt crises, if a Govt or a company defaults on its bond it leads to losses and investments become harder to recover.
An illiquid security	**Inaccurate valuation** can mislead investors, have an impact on their investment decisions, and possibly result in financial loss. It is caused by a heavy reliance on assumptions brought on by a lack of transaction data. **Sensitivity to assumptions:** There's more subjectivity and presumption-making involved. In the event that these presumptions lack foundation or fail to account for alterations in market conditions, the model's output may be highly	**Liquidity:** These assets' liquidity may further decline during a financial crisis. There is a chance that investors will experience distress if they have trouble selling or leaving positions in illiquid securities. **Bid-ask spreads widening:** When market participants grow more risk averse during financial crises, these spreads may widen even more, increasing traders' transaction costs. Illiquid securities are sought after by

	susceptible to errors. **Issues with regulatory compliance:** Regulators frequently demand precise financial instrument risk assessment and valuation. When it comes to illiquid securities, model errors can cause problems with compliance if the model is unable to offer the transparency and accuracy that regulatory standards demand.	buyers and sellers.

Step 2: Identifying Data

1. **Data Type:**

- **Market Prices: Historical and real-time prices of relevant financial instruments, including stocks, bonds, and derivatives.**
- **Economic Indicators: Key economic data such as GDP growth, inflation rates, unemployment rates, and PMI, ...**
- **Volatility Measures: Historical and implied volatility indices to gauge market uncertainty.**
- **Credit Spreads: Spreads between government bonds and corporate bonds to assess credit risk.**
- **Foreign Exchange Rates: Exchange rates for currencies relevant to the portfolio.**

2. **Data Processing: Modeling credit risk, scoring models or borrower, default probability analysis, market modeling, collateral valuation, interest rate prediction, liquidity modeling, Financial ratio Calculation, Stock price volume analysis, Volatility analysis, Leverage analysis, Stress test, Fundamental & Technical analysis.**

3. **Data Frequency:**

- **Daily Closing Prices: Essential for daily valuation and risk assessments.**
- **Intraday Prices: For high-frequency models or strategies that rely on intraday data.**
- **Economic Data Releases: Timely updates on economic indicators as they are released.**
- **Monthly/Quarterly Reports: Financial statements and reports from relevant companies.**

4. **Data Class: Credit, real estate, Equity, Central bank, sectorial research agencies**

5. **Data Source:**

- **Market Data Providers: Bloomberg, Reuters, or other financial data vendors.**
- **Central Banks: For economic indicators and interest rate data.**
- **Government Agencies: Economic data and fiscal policy updates.**
- **Company Filings: Financial statements and reports from relevant companies.**

6. **Data Variety:**

- **Structured Data: Standard market prices, economic indicators, and financial statements.**
- **Unstructured Data: News sentiment, social media analytics, and qualitative information.**
- **Alternative Data: Non-traditional datasets such as satellite imagery, web scraping data, or credit card transactions.**

- **Money at a fixed rate for an unsecured purchase (e.g. credit card) for an individual.**
    1. **Data Type: loan amount, credit score, income and employment status, other debts, utilization rates, interest rates**
    2. **Data Preprocessing: modeling credit risk, scoring models or borrower, default probability analysis**
    3. **Data Frequency: Monthly, Quarterly, Annually and all history**
    4. **Data Class: Credit**
    5. **Data Source: credit bureaus, banks, customer submission, interest rate indexes**
    6. **Data Variety: Actual Data, Modeled Data, Adjusted Data, Relative Data**

- **Money at a floating rate for a secured purchase (e.g. home or automobile) for an individual.**
    1. **Data Type: property value, loan amount, credit score, income and employment status, other debts, utilization rates, interest rates, market trends**
    2. **Data Preprocessing: modeling credit risk, scoring models or borrower, default probability analysis, market modeling, collateral valuation, interest rate prediction**
    3. **Data Frequency: Monthly, Quarterly, Annually**
    4. **Data Class: Credit, real estate**
    5. **Data Source: credit bureaus, banks, customer submission, interest rate indexes, property dealers**
    6. **Data Variety: Trade Data, Actual Data, Observed and Modeled Data, Adjusted Data, Relative and Absolute data.**

- **Money at a fixed rate for a business for a construction loan.**
    1. **Data Type: Loan value, collateral value, current debt amount, interest expense, economic indicators affecting construction industry (e.g., GDP, housing starts), Credit ratings of borrowers, interest rates, regulatory changes.**
    2. **Data Processing: Loan performance metrics, Volatility of interest rates and construction market indicators**
    3. **Data Frequency: Weekly, Quarterly, Annually**
    4. **Data Class: Credit, fixed income, real estate**
    5. **Data Source: Financial Statements, Industry Data, Company Data, Economic Indicators**
    6. **Data Variety: Actual Data, Observed Data, Estimated Data, Modeled Data, Real-time data**

- **Publicly traded Equity (e.g. common stock) – that is, securities lending of a Stock.**
    1. **Data Type: OHLC prices, Volume, Dividend yields, EPS, P/E Ratio, Market Cap**
    2. **Data Processing: Adjustments for stock splits and dividends, Financial ratio Calculation, and Stock price volume analysis.**
    3. **Data Frequency: Daily, Quarterly, weekly, Annually**
    4. **Data Class: Equity**
    5. **Data Source: Exchanges, Financial Reports, Financial statements**
    6. **Data Variety: Quote data, Trade Data**

- **Publicly traded bond (e.g. treasury bond, corporate bond) – that is, securities lending of a bond.**
    1. **Data Type: Ratings Data, Yield to maturity, Credit Spreads, Coupon Rates**
    2. **Data Processing: Levels, Price to Yield, issuer credit worthiness**
    3. **Data Frequency: Varying frequency**
    4. **Data Class: Credit data**
    5. **Data Source: Exchanges, Brokers, Credit rating agencies**
    6. **Data Variety: Modeled data, Trade data**

- **An illiquid security – Small-cap stocks.**
    1. **Data Type: market capitalization, shares outstanding, financial statements**
    2. **Data Processing: stock prices, dividend yields, financial ratio,**
    3. **Data Frequency: Daily, Quarterly, Weekly, Anually**
    4. **Data Class: Equity, Market Indices**
    5. **Data Source: Exchanges, Financial Reports, Financial statements**
    6. **Data Variety: Quote data, Modeled data, Trade data**

Step 3: Ethical Considerations Based on Fallout

	Ethical Challenges	Undesirable Results
Money at a fixed rate for an unsecured purchase	**Excess spending**: offering loans to borrowers may increase the chance of unnecessary excess spending. **Intended defaults**: as unsecured loans have no collateral, a borrower may intend to default at the beginning of the purchase rather than planning to repay the loan.	**Worsen financial status**: the financial status of the borrower may get worse due to difficulty in repaying the loan. **Higher default rate:** those would intend to default increase the default rate, which the cost would be born by lending and passed down to all other borrowers.
Money at a floating rate for a secured purchase	**Predatory lending:** lender competes to lend money to borrowers would cannot afford the risk or who are unaware of the risk for profits. **Technical default:** for non-recourse loans, a borrower may choose to default when the collateral value falls below the loan amount.	**High default rate:** for the subprime borrowers, predatory lending contributes to a significant portion of the default rate (Agarwal et al. 29). **"Free option":** a non-recourse loan is like a free option which the borrower could enjoy the upside but limit the downside up to the loan value. The loss would be born by the lender especially during market downturns.
Money at a fixed rate for a business for a construction loan	**Pricing fairness:** Determining a fixed rate necessitates forecasting future expenses and risks. Lenders risk underestimating risk because of biases or limitations in their models, which could lead them to offer loans at interest rates that are not really sustainable and endanger the stability of their finances. their primary. On the other hand, overestimating risk may result in excessive interest rates, which would prevent worthy companies from obtaining loans. It's critical to strike a balance between	**Enhanced risk:** Lenders who use fixed interest rates run the risk of suffering a loss if building costs rise or if the borrower defaults. This risk may be made worse by an inaccurate risk assessment brought on by model limitations or insufficient data. **Restricted financial success:** Fixed rate loans, as opposed to variable rate loans, potentially limit the lender's ability to profit from higher interest rates by locking in fixed profits. In a market where competition is fierce, this might be less

	reasonable risk management and fair pricing. **Openness and disclosure of information:** Companies should have access to comprehensive and unambiguous information regarding the terms and conditions of fixed-rate loans, including any potential risks associated with interest rate increases or other unforeseen project obstacles. The omission of crucial details or the use of difficult-to-understand language can raise moral questions about informed consent and justice.	appealing. **Liquidity concerns:** Construction loans frequently entail substantial sums of money that are locked up for extended periods of time, which lowers the lender's liquidity and may make it more difficult for it to comply with regulations. their additional investment groups.
Publicly traded Equity	The borrowers are using simulated data instead of real data without disclosure and borrowing large quantities of security for shorting based on simulated data.	It can lead to disastrous results as in real data things might be different which can lead to severe losses as well as default on the borrowing.
Publicly traded bond	In publicly traded bonds Smoothing and extrapolating Bond data can be a big challenge as bonds are not traded frequently it becomes difficult to value because of a lack of fungibility, and it is hard to provide accurate marks. Also as bonds have a non-linear nature extrapolating data can cause a challenge to assume the trend.	Due to the discussed challenges, bonds will look easier to value but in the real sense, it is not which can give us false assumptions. In the case of extrapolating data, we can have wrong assumptions about the trend and if we are borrowing security which means we are having leverage it can lead to big losses.
An illiquid security	**Transparency and information asymmetry:** these factors frequently entail less standard reporting and information disclosure, which creates an information asymmetry between issuers and investors and can make it challenging for investors to evaluate risks and make wise decisions.	**Limited Liquidity:** The primary impediment is the absence of markets where securities can be purchased or sold. This may limit your financial flexibility and render your investment capital unsuitable for short-term needs by making it difficult to access quickly. **Difficulties with valuation:** Due

	Challenge of exit: Investors may find it difficult to withdraw from positions due to restricted liquidity options. This could result in capital being stuck and reduce financial flexibility, particularly for those who depend on liquidity. **Legal:** Ensuring ethical market practices may be difficult if the regulatory framework does not fully address all ethical concerns relating to illiquid investments.	to a lack of trading data and the need for intricate models or arbitrary judgments, it can be challenging to accurately value illiquid securities. This may result in erroneous portfolio valuation and uncertainty regarding the actual value of your investments. **Increased transaction costs:** Compared to publicly traded assets, buying and selling illiquid securities frequently entails larger fees and commissions, which further limits your potential profits. **Market risks and fluctuations:** Because there are fewer trading activities, illiquid securities are frequently more susceptible to unanticipated events and market fluctuations. This may result in notable changes in price as well as possible losses. Information asymmetry: Illiquid investments usually have fewer disclosures and less information available than publicly traded securities. This can make it challenging to evaluate risk and choose wisely when making investments.

Step 4. Ethical Considerations Based on Data

1) Money at a fixed rate for an unsecured purchase (e.g. credit card) for an individual

- **Data collection and use:**
  - **Challenges:** Overly comprehensive financial and personal data collection, beyond what is required to post bail, raising privacy issues and the possibility of misuse.
  - **Best practices:** include obtaining informed consent, gathering only the information required for loan evaluation, adhering to data privacy laws, and being open and honest about how you use data ("GDPR Archives - GDPR.eu") ("California Consumer Privacy Act (CCPA) | State of California - Department of Justice - Office of the Attorney General").
- **Algorithm:**
  - **Challenges:** Based on past data, credit scoring algorithms are skewed toward specific demographic groups, which exacerbates inequality and unjust denials.
  - **Best practices:** Test bias detection algorithms frequently, make use of a variety of data sets, exercise human judgment, and provide fair justification for lending decisions (Fondrie).
- **Data sharing and debt collection:**
  - **Challenges:** Giving debt collectors access to borrower information without getting permission can result in invasions of privacy and forceful collection methods.
  - **Best practices:** Obtain borrower consent, limit data sharing to what is required by law, and make sure that responsible collection practices are followed (Fondrie).

3) Money at a fixed rate for a business for a construction loan

- **Gathering and using data:**
  - **Challenges:** Gathering too much information beyond what is required for underwriting, such as confidential company data, creates privacy and misuse issues.
  - **Best practices:** include obtaining informed consent, gathering only the information required to assess the loan, adhering to data privacy laws, and being open and honest about how your data is used. ("California Consumer Privacy Act (CCPA) | State of California - Department of Justice - Office of the Attorney General")
- **Algorithm:**
  - **Challenges:** Credit scoring models favor certain industries or business types, leading to unfair denials and limited access to capital.
  - **Best practices:** Regularly test bias detection algorithms, use diverse data sets specific to construction businesses, perform human oversight, and explain decisions to borrow fairly. (Fondrie)
- **Data breaches and security:**
  - **Challenges:** Sensitive financial data and construction plans are exposed by data breaches, which increases the risk of identity theft, financial loss, and possible theft of intellectual property.

- ➢ **Best practices:** Put robust cybersecurity measures in place, encrypt data, update security procedures often, and alert borrowers to infractions as soon as possible. (“Cybersecurity | NIST”)

❖ **Competitive exchange of data and information:**

- ➢ **Challenge:** Sharing borrower data with competitors or third parties without consent, leads to unfair competition and potential for abuse.
- ➢ **Best practices:** Obtain borrower consent, limit data sharing to what is required by law, and make sure third-party data handling is done responsibly.

4) Publicly traded Equity (e.g. common stock)

❖ **Insider trading and market manipulation:**

- ➢ **Challenges:** Creating an unfair playing field by using confidential information to obtain an unfair advantage in transactions.
- ➢ **Best practices:** Establish stringent guidelines for insider trading, restrict access to private information, support initiatives for whistleblowers, and assist with regulatory inquiries. (“Regulatory Actions”)

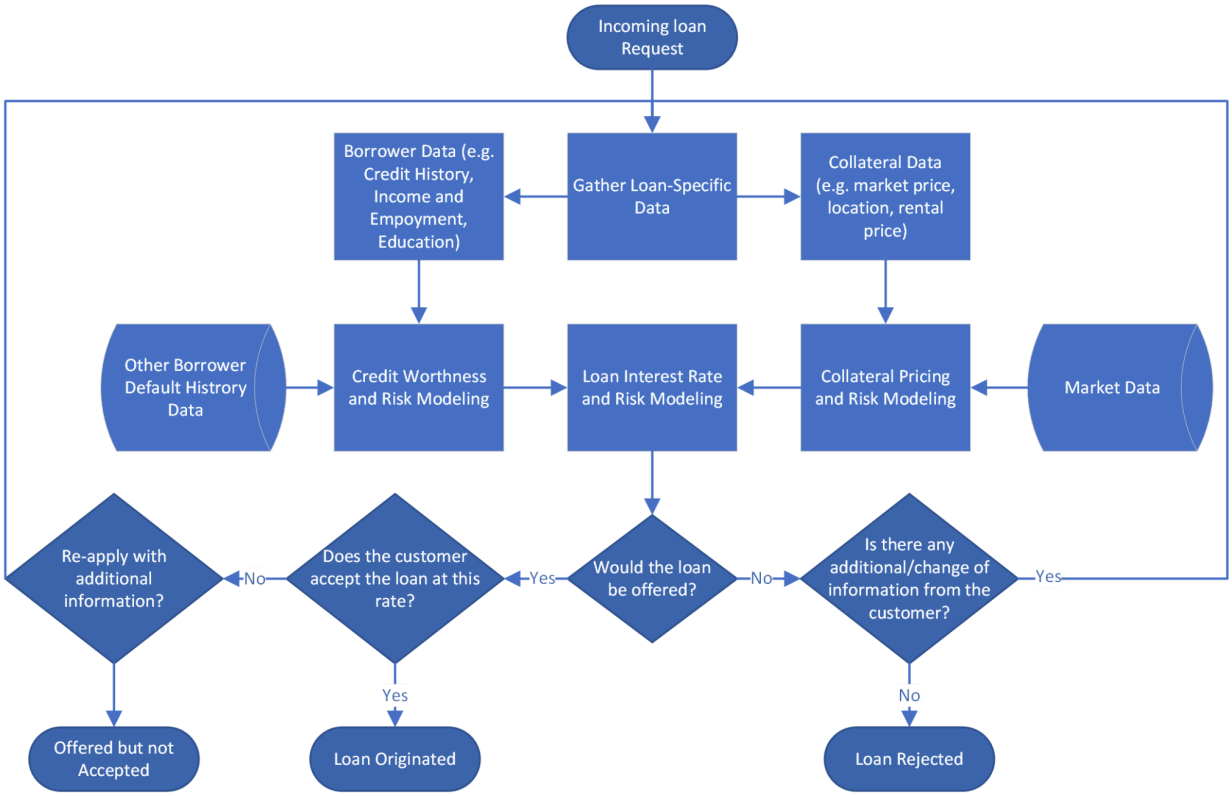
❖ **False information and news reports:**

- ➢ **Challenges:** Inaccurate or deceptive information about businesses is disseminated online, which has a negative impact on investor confidence and stock prices.
- ➢ **Best practices:** Promote truthful and open communication from businesses, raise investors' media literacy, and work with social media companies to combat false information (“Regulatory Actions”).

❖ **Add good data to bad data**

- ➢ **Challenges:** Construct a distorted narrative by combining accurate data with false or misleading information.
- ➢ **Best practices:** Establish explicit guidelines for including data in financial reports, carry out extensive due diligence on data sources, promote independent verification of financial information, and implement data validation procedures to find and fix errors.

Step 5. Implementation for Money at a Floating Rate for a Secured Purchase



The above workflow diagram describes the workflow for the assessment and origination process for a secured loan, specifically for a property loan. The process begins with a customer request, followed by the gathering of loan-specific information, which could be either user-submitted or pulled from third parties e.g. credit associations, banks, property pricing agencies, or property brokers and agencies. The pulled data are accessed separately for the customer side to evaluate the creditworthiness and risk for the customer using financial modeling and historical data, and on the collateral side for the valuation and market risk for the collateral also using financial modeling and market data. The two sides are combined in a final decision model to suggest the particular loan decision and the attached interest rate of this specific customer and property. If the loan is offered, the customer could choose to accept or decline the offer. If the customer is not satisfied with the offer or the loan is rejected, the customer could choose to submit additional information for re-evaluation.

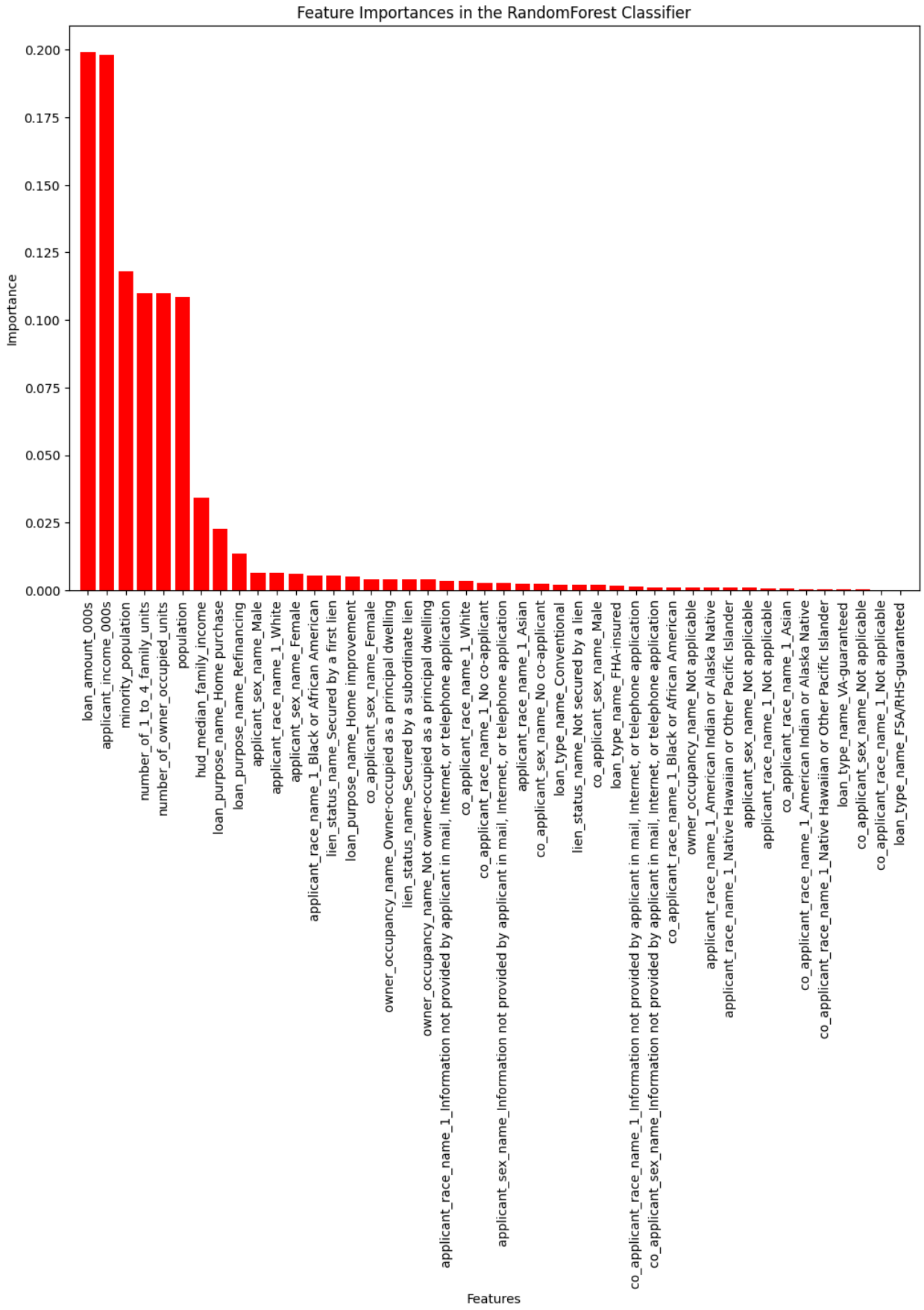
The whole process is powered by financial modeling of the risk using a combination of different methods and with the support of historical data. We use the historical defaults and risk assessments of other customers with demographic information to model the creditworthiness of customers, which is used to evaluate the risk of the current customer. Specifically, we use the 2007 and 2017 New York HMDA datasets (Consumer Financial Protection Bureau *HMDA Data*), which contain the demographic features and loan evaluation outcomes. We select a subset of features namely `"applicant_income_000s", "applicant_race_name_1", "applicant_sex_name", "co_applicant_race_name_1", "co_applicant_sex_name", "lien_status_name", "loan_purpose_name",`

`"loan_type_name"`, `"owner_occupancy_name"`, `"hud_median_family_income"`, `"loan_amount_000s"`, `"number_of_1_to_4_family_units"`, `"number_of_owner_occupied_units"`, `"minority_population"`, `"population"` as input feature to the model. We consider a loan was approved if the outcome is `'Loan originated'`, `'Application approved but not accepted'`, or `'Preapproval request approved but not accepted'` we consider the loan is approved (1), and if the outcome is `'Application denied by financial institution'`, or `'Preapproval request denied by financial institution'`, we consider the loan is rejected (2). If the outcome of a record does not fall into any of the above-mentioned, we discard the record. We convert the categorical values into one-hot encoding with imputation and then build a random forest on the features to classify the loan outcome (approved or rejected).

We use the 2007 data as the training and validation set, and the 2017 data as the test set. We want to find out the research question: “Does the model built in 2007 still apply to 2017 data?”.

In the result, we found that the random forest model achieves 67.3% accuracy and 0.62 macro F1 on the validation set (a subset of 2007 data), and 77.0% accuracy and 0.60 macro F1 on the test set (2017 data). The reason for the difference in accuracy and macro F1 is due to label imbalance in the two datasets. In the 2007 dataset, 35.3% of the loans were rejected, and in the 2017 dataset, only 21.3% were rejected. In this case, the macro F1 would be a more accurate measurement of the prediction quality. The macro F1 was reduced by 3% from 2007 data to 2017 data, showing a moderate model failure with time.

We plot the feature importance of the model below to understand which feature contributes the most to the random forest model.

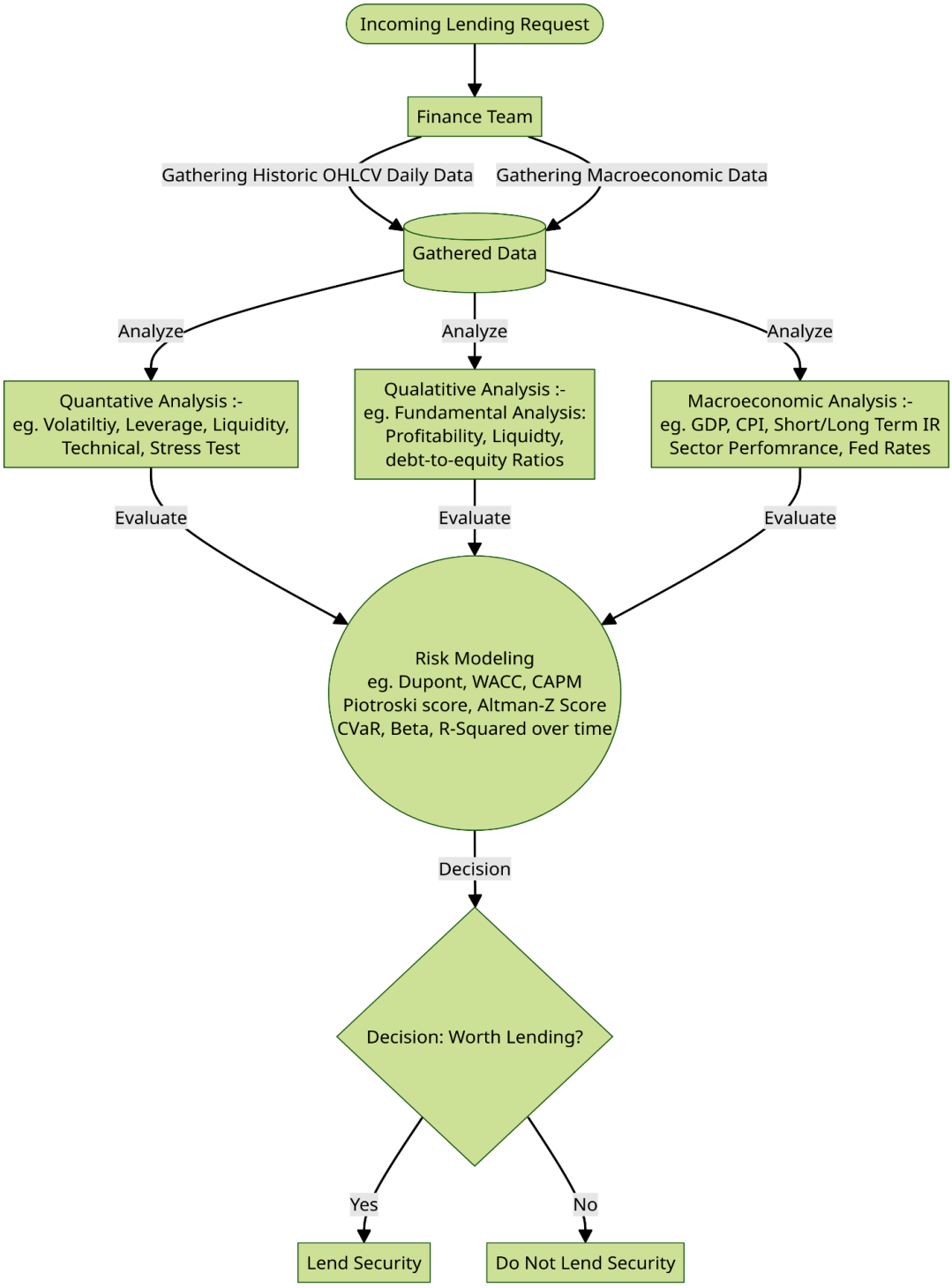

Feature Importances in the RandomForest Classifier
Importance
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
loan_amount_000s
applicant_income_000s
minority_population
number_of_1_to_4_family_units
number_of_owner_occupied_units
population
hud_median_family_income
loan_purpose_name_Home purchase
loan_purpose_name_Refinancing
applicant_sex_name_Male
applicant_race_name_1_White
applicant_sex_name_Female
applicant_race_name_1_Black or African American
lien_status_name_Secured by a first lien
loan_purpose_name_Home improvement
co_applicant_sex_name_Female
owner_occupancy_name_Owner-occupied as a principal dwelling
lien_status_name_Secured by a subordinate lien
owner_occupancy_name_Not owner-occupied as a principal dwelling
applicant_race_name_1_Information not provided by applicant in mail, Internet, or telephone application
co_applicant_race_name_1_White
co_applicant_race_name_1_No co-applicant
applicant_sex_name_Information not provided by applicant in mail, Internet, or telephone application
applicant_race_name_1_Asian
co_applicant_sex_name_No co-applicant
loan_type_name_Conventional
lien_status_name_Not secured by a lien
co_applicant_sex_name_Male
loan_type_name_FHA-insured
co_applicant_race_name_1_Information not provided by applicant in mail, Internet, or telephone application
co_applicant_sex_name_Information not provided by applicant in mail, Internet, or telephone application
co_applicant_race_name_1_Black or African American
owner_occupancy_name_Not applicable
applicant_race_name_1_American Indian or Alaska Native
applicant_race_name_1_Native Hawaiian or Other Pacific Islander
applicant_sex_name_Not applicable
applicant_race_name_1_Not applicable
co_applicant_race_name_1_Asian
co_applicant_race_name_1_American Indian or Alaska Native
co_applicant_race_name_1_Native Hawaiian or Other Pacific Islander
loan_type_name_VA-guaranteed
co_applicant_sex_name_Not applicable
co_applicant_race_name_1_Not applicable
loan_type_name_FSA/RHS-guaranteed
Features

From the figure above, we found that the dominating feature is loan amount and applicant income, followed by other demographic features.

In future studies, we could also use historical market information to build a property pricing model to calculate the value of the current collateral and the risk of the collateral. We could evaluate the risk of the property by modeling the price movement and the probability of returns, combined with loan terms to model the chance of being undercollateralized and defaulted.

With this study, we presented the flow of secured loan evaluation, built a practical model using a real-world dataset, and evaluated the challenge of model failure using a newer dataset. We found that we should be cautious when building and using data in the real world when the data distribution could change over time. Continuously updating the model is needed to adapt to changes in the data pattern.

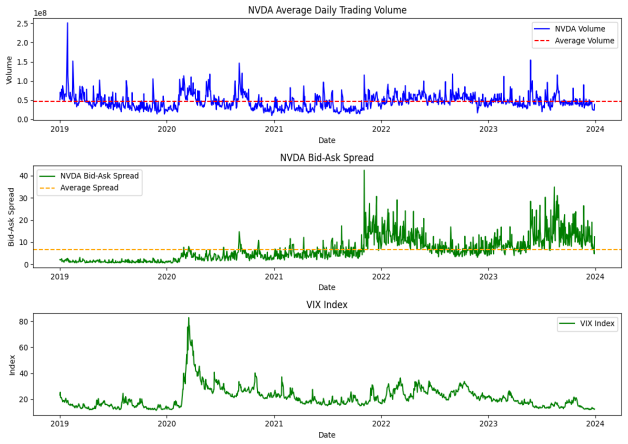
Step 5. Implementation for Publicly traded Equity (e.g. common stock)

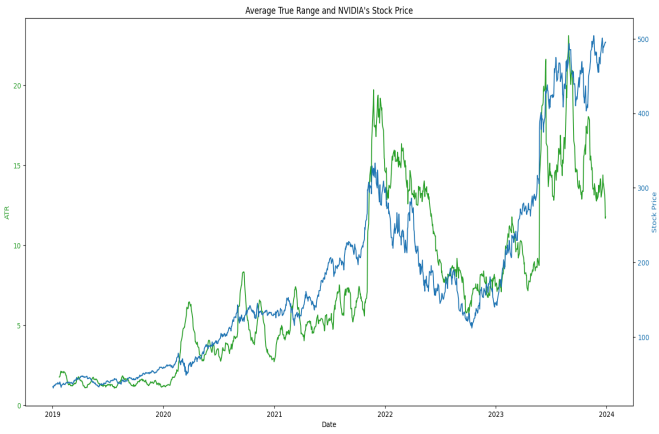


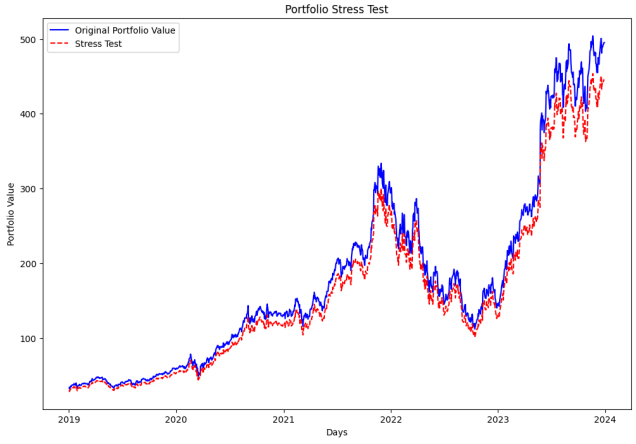
The above diagram illustrates the workflow for the assessment and origination process for lending a publicly traded security.

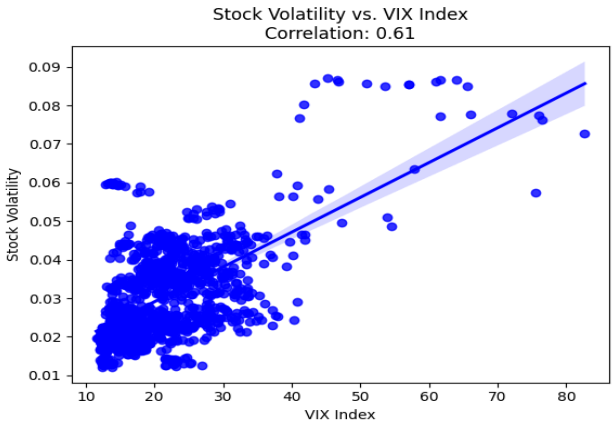
We are using 5 years of historical data of Nvdia from (2019-2023) to understand the workings of our model, Nvdia is a leading American multinational technology company, renowned for its graphics processing units (GPUs) and AI-driven computing solutions and our data source is Yahoo Finance ("NVIDIA Corporation (NVDA) Stock Price, News, Quote & History"). To get Macroeconomic data as well as doing fundamental analysis we are using financial modeling prep API ("Financial Modelling prep").

The gathered data then go through three analysis processes i.e. quantitative analysis, qualitative analysis, and macroeconomic analysis. Quantitive analysis mainly involves the use of mathematics and statistics to analyze the financial instrument (Courage), In this process Liquidity Analysis, Volatility Analysis, Leverage Analysis, Technical Analysis, and Stress tests are done to understand the market dynamics of the security.









In the above Figures We can see our Liquidity Analysis, Volatility Analysis, Leverage analysis and stress test and as we can see it has performed well in all the benchmarks we will move forward to the next process which is Qualitative analysis.

In which we try to understand mostly the non-quantifiable information like management expertise, Industry cycle, R&D approach future proofing, Moat, etc ("Qualitative Analysis"). For this, we do a fundamental analysis, in which we understand the Liquidity, profitability, and Debt-to-equity Ratio of the assets.

As Nvdia is a World's leading Manufacturer of GPU's, and with the rise of LLM and other AI innovations the world will need more computation engines which provides Nvdia a Moat in this sector. Also if we consider other fundamental aspect of the company we can see The **current Ratio** of Nvdia in 2023 is **3.3** and the **avg current ratio** in last 5 yers is **5.9** which suggest that the asset have good liquidity Also the company has **1.6 billion dollars** of **working capital** which is good as they are highly R&D and Manufacturing centric business. Now when we look at Profitibility margin we can see the **Net profit margin** of Nvdia is **16.19%** which is good as it is a manufacturing company highly dependent on R&D. The **ROE** is **17.93%** in 2023 and Avg of last 4 years is **28.75%**, The **Inventory Turnover Ratio** of **2.99** as Nvdia a highly specialized heavy equipment manufacturer with an High demand on in certain industries. The **debt to equity ratio 53.64%** in 2023 which can be considered normal as it is heavy R&D centric manufacturing business also the company has enough workin cash so there is nothing to worry about.

In our third process, we go through the macroeconomic data of the country to understand the country from an economic perspective (Boyle). In our analysis we have found there has been some inflationaly pressure as the **CPI** is rising in last 5 years and in 2023 it is **123.47** Also the the **GDP** growth have also slowed in USA But Technology as a sector have performed well in during last months of 2023 which is a good news . L**ong / Short Term Intrest Rates** have been increase to fight the inflationary pressure. **Fed Rates** have also increased to fight inflation. So overall macroeconomic condition does not look very promising but the sector havse performed well.

After analyzing various risk modeling methods (Scott), including Dupont analysis (Hargrave), WACC (Hargrave), CAPM (Kvilhaug), Piotroski Score ("What Is a Piotroski Score? Definition, Meaning, and Example"), Altman Z-score (Rathburn), CVaR (Scott), Beta (Liberto), and R-squared (Fernando and Perez), it appears that the asset shows mixed results. While Dupont and WACC models indicate high variance in certain performance metrics, Piotroski Score and Altman Z-score suggest stability and safety. However, further investigation is needed due to conflicting indicators from CVaR and Beta. R-Squared and CAPM shows other picture as the asset have not performed well on the bench marks and also seem volatile in comparison to the market.

Some further deep due-deligence is need for futures studies using some more robust custom models. We also need to compare the models with the peers performance and analyze the current market situations.

With this all we finally conclude our lending process workflow, we tried to build a framework based model using real historic data of an publicly traded asset and evaluated all the necessary challenges. We found that we should not only understand the market dynamics like Liquidity, Leverage, Volatility but also fundamental as well as macro level data as there is lots of variables which constantly changes as we can see our assets have performed well in Quantitave and Qaualititve analysis but on the macro scale and Risk modeling the pictures were different. Many models have their limitation in our case also there

were some data missing as well as there were some different assumptions of the models. So we need to continuously update and try to build custom models according to our needs and as scenarios change we must also change.

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