

CREDIT DEFAULT RISK

Sector: Financial Services – Mortgage Lending

Team Members

Gokul VKS - 2401020094

Isha Tomar - 2401020096

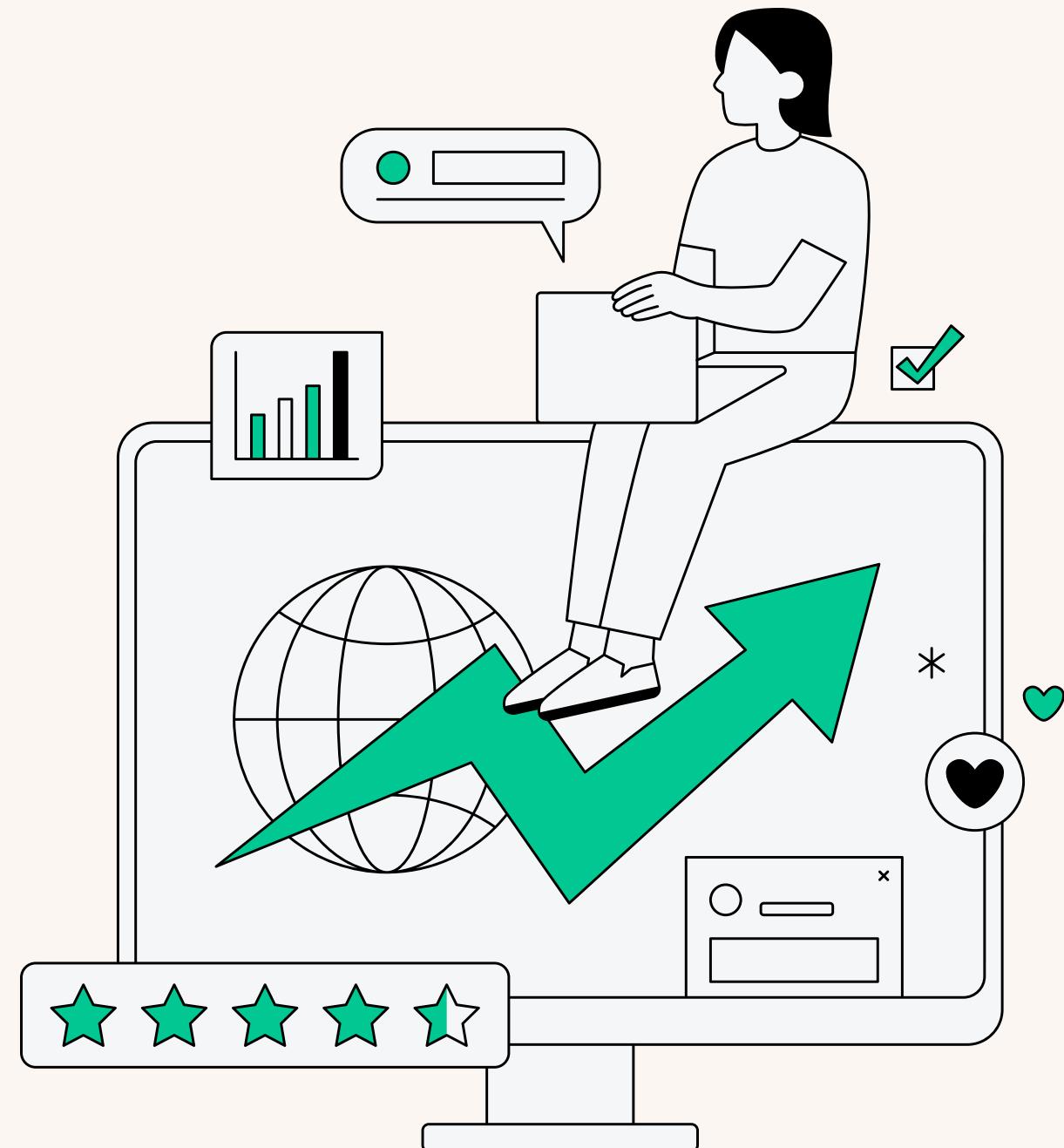
Nachiket Amlekar - 2401020039

Saksham Sontakke - 2401010404

Manikanta - 2401010457

Adarsh Vashistha - 2401010026

Faculty Mentor - Archit Raj



Credit Risk Landscape: Context & Challenge

Why This Matters

- Mortgage loans create long-term capital exposure (10–30 years)
- 23.67% portfolio default rate signals structural vulnerability
- Regulatory capital requirements tie risk directly to profitability

Decision-Maker

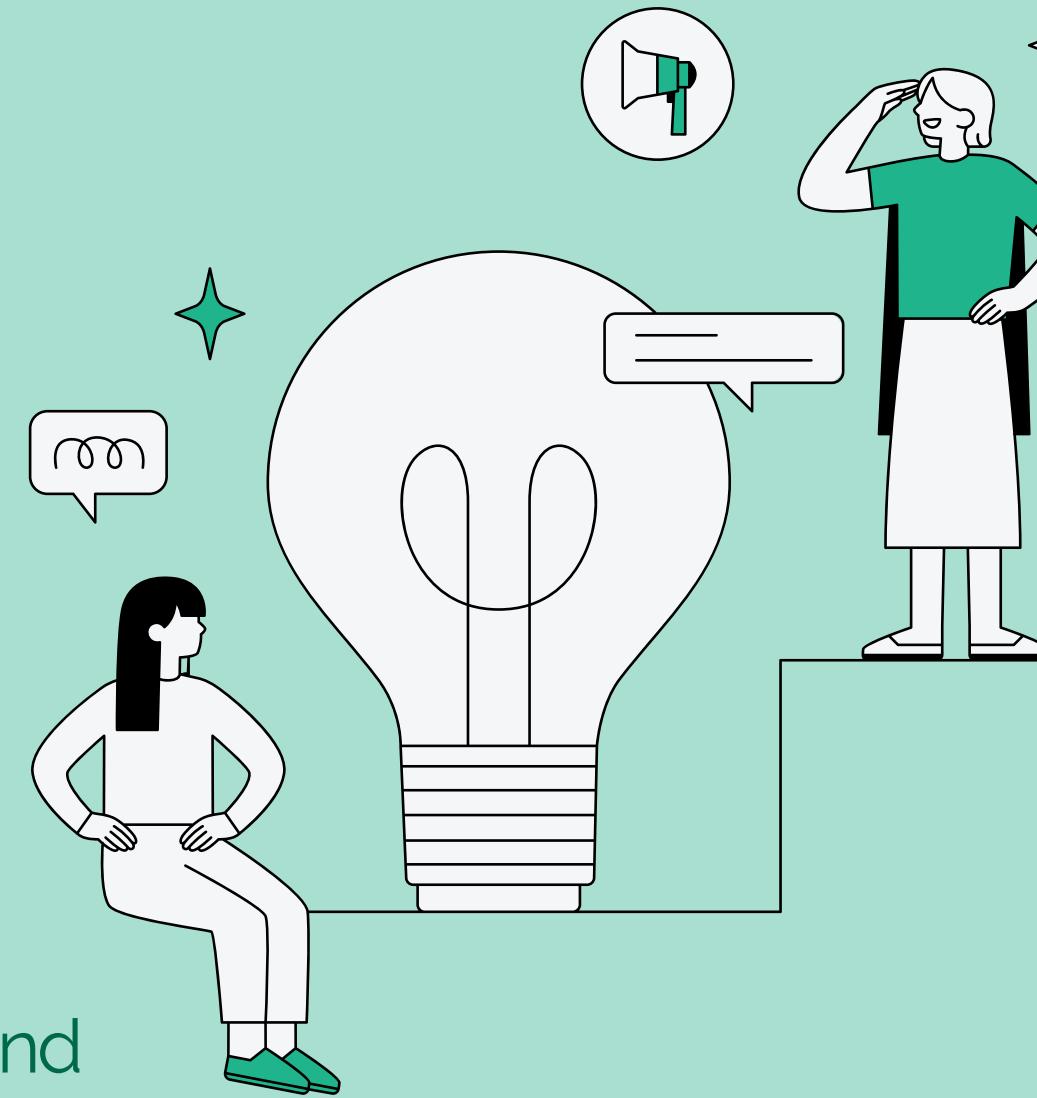
Chief Risk Officer (CRO) & Credit Policy Committee

Core Business Question

Which borrower and loan attributes drive default risk, and how should underwriting policy change?

Objective

To identify structural default drivers and enable data-driven underwriting and pricing decisions that reduce capital exposure.



Data Engineering (Source to Insight)

Source

Dataset: Loan Default Dataset

Platform: Kaggle

Time Period: 2019

Size: 10,000 rows × 36 columns

Portfolio Value: \$3.30 Billion

Average Loan Size: \$330,042

Cleaning & Preparation

- Handled missing values (Income, Interest Rate, DTI)
- Standardized categorical variables (Region, Gender, Approval Status)

Edge Case Handling:

LTV > 100% retained as valid high-risk loans (not removed)

- Engineered risk buckets (LTV & Credit Score Segmentation)

Data Dictionary

Target variable

Default Status (Yes / No)

Borrower Risk Indicators

Credit Score

Debt-to-Income (DTI)

Income

Leverage & Exposure

Loan Amount

Loan-to-Value (LTV)

Structural & Geographic Factors

Region

Loan Type

Loan Purpose

Occupancy Type

Key Performance Indicators

How often does default occur?

- Portfolio Default Rate – 23.67%
 - Baseline measure of overall credit health
- High-Risk Borrower % (LTV > 80%)
 - Measures leverage-driven vulnerability
- Income Stress Ratio
 - Captures debt burden concentration among defaulters

How much money is at risk?

- Exposure at Default – \$749.2M
 - Total capital tied to defaulted loans
- Loss Contribution – 22.7% of portfolio
 - Share of portfolio value represented by defaults
- Average Exposure per Defaulted Borrower
 - Measures individual loss severity

Are underwriting & pricing decisions working?

- Approval Effectiveness Ratio
 - Tests whether approved borrowers actually perform
- Prime Borrower Ratio
 - Indicates credit quality at origination
- Risk-Based Pricing Gap
 - Evaluates whether defaulters were priced higher for risk

Key Insights

Where Is Default Risk Concentrated?

1. Extreme Leverage Drives Defaults

Very High LTV (>100%) loans show an 88% default rate.

→ Leverage is the strongest structural risk factor.

2. Credit Score Alone Is Not Predictive

Default rates remain ~23-24% across all score bands.

→ Traditional credit scoring is insufficient.

3.FHA Loans Show Elevated Risk

FHA loans default at 34% vs 21.6% for conventional loans.

→ Product-level underwriting matters.

4.Geographic Risk Imbalance

North-East and Central regions exceed portfolio average default rates.

→ Risk concentration exists by region.

5.Investment Properties Are Riskier

28% default rate vs 23% for primary residences.

→ Secondary/investment exposure increases vulnerability. • Portfolio Default Rate –23.67%

6. Joint Applications Reduce Risk

Joint borrowers default at 19.65% (lowest segment).

→ Dual-income structure improves repayment stability.

Advanced Analysis

1. Risk Segmentation

The intersection of Very High LTV and FHA-backed loans forms the portfolio's most concentrated default cluster.

→ This segment combines weak collateral coverage with higher-risk loan programs.

2. Risk-Based Pricing Assessment

Average interest rates for defaulters and non-defaulters show minimal variation.

→ High-risk borrowers were not meaningfully priced higher at origination.

3. Scenario Simulation – LTV Cap $\leq 100\%$

If implemented:

- 356 defaults avoided
- Default rate reduces from 23.67%

→ ~20.93%

- Estimated \$125–150M reduction in exposure

→ Targeted leverage control materially improves portfolio quality.

4. Approval Effectiveness Evaluation

Pre-approved loans were assessed to test screening strength.

→ Current screening adds limited risk differentiation.

5. Geographic Concentration

North region holds the largest capital exposure (\$1.6B+).

South region combines high loan volume with elevated defaults.

North-East shows highest default rate but lower exposure weight.

→ Risk must be evaluated using both default rate and capital concentration.

Capital

Dashboard Walkthrough

Executive View

- Total Capital Exposure by Region
- Portfolio Default Rate & Concentration
- Exposure by LTV Risk Tier
- Risk Distribution by Loan Type

→ Enables rapid assessment of portfolio health and capital vulnerability.

Operational View

- Allows detailed analysis across:
- Region-level default intensity
 - Loan Purpose performance
 - LTV Risk Bucket segmentation
 - Credit Score band analysis
 - Occupancy & collateral structure
 - Pricing vs default comparison
- Supports targeted underwriting and pricing decisions.

Recommendations

1. Enforce Hard LTV Cap ($\leq 100\%$)

- 88% default rate makes this segment structurally unsustainable
- Removing this tier cuts ~356 defaults
- Reduces exposure by ~\$125–150M

2. Introduce Regional Risk Pricing

- North-East (35.6%) and Central (26.8%) exceed portfolio average
 - Apply 25–50 bps premium or stricter LTV caps

3. Strengthen FHA Underwriting Standards

- FHA default rate: 34% (highest among loan types)
 - Increase minimum credit score + tighten income verification

4. Promote Joint Applications

- Joint borrowers default at only 19.6%
- Offer small rate incentive to encourage dual-income applications

5. Move to Multi-Factor Approval Model

- Credit score alone shows weak predictive power
- Require LTV + DTI thresholds for standard approval

Financial Impact & Strategic Value Creation

1. LTV Cap Policy ($\leq 100\%$)

- 356 defaults avoided
- \$125–150M reduction in exposure
- Default rate improves from 23.67% → 20.93%

2. FHA Underwriting Tightening

- ~69 defaults avoided
- \$23–28M capital preserved

3. Joint Application Incentive

- Portfolio default reduction: 0.3–0.5%
- \$10–15M annualized savings

4. Dual-Trigger Model (LTV + DTI)

- Even 2% reduction in defaults = ~\$66M lower exposure

Strategic Value

- Lower Non-Performing Asset (NPA) ratio
- Reduced capital buffer pressure under regulatory norms
- Improved risk-based pricing discipline
- Stronger portfolio resilience in economic downturn



Collectively, these policy adjustments could preserve over \$200M in capital while improving long-term portfolio stability.

Analytical Limitations

Data & Time Scope Constraints

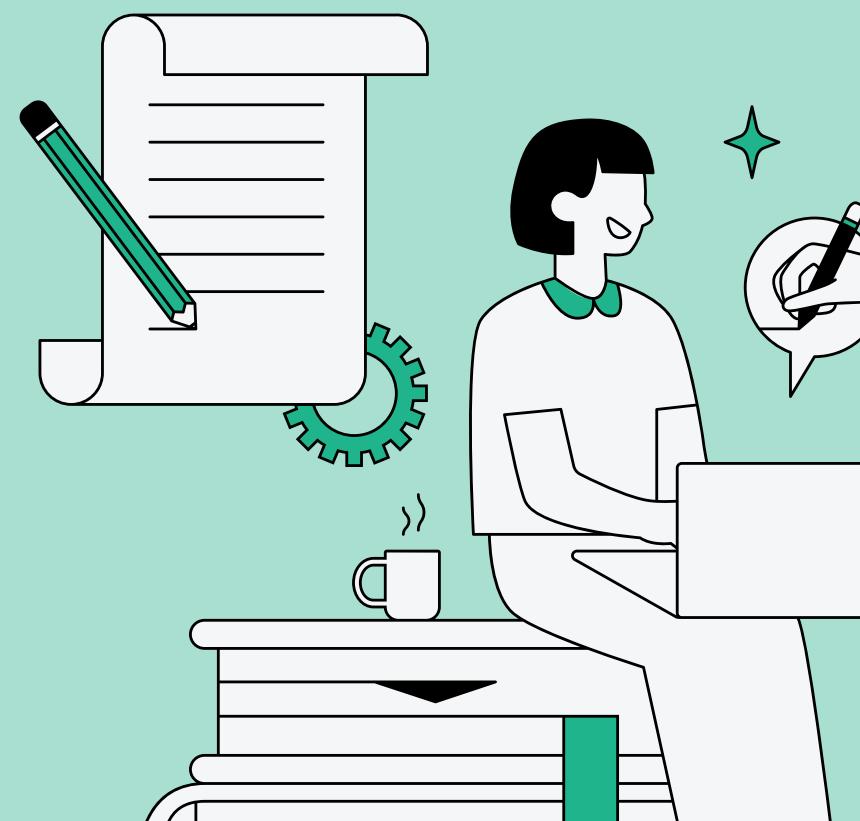
- Dataset limited to a single origination year (2019)
 - no trend or cycle comparison
- Absence of macroeconomic variables (unemployment, rate cycle, housing index)

Modeling & Risk Measurement Gaps

- Default captured only as final outcome — no delinquency timeline
- No recovery or collateral liquidation data → LGD not measurable
- Expected Loss ($PD \times LGD \times EAD$) cannot be fully computed

Data Quality Considerations

- Median imputation applied to missing income, property value, and interest fields
- Large “Unknown” gender segment limits demographic precision
- Cross-bureau credit scores may not be perfectly standardized



Future Roadmap

1. MultiYear Portfolio Expansion

Incorporate 2017–2022 data to distinguish structural vs cyclical defaults.

2. Predictive Default Modeling

Build Logistic Regression Decision Tree model using:
LTV + DTI + Loan Type + Region

5. Enterprise Dashboard Deployment

Migrate to Looker Studio for automated refresh and management access.

3. Full Expected Loss Framework

Integrate recovery data to compute:

$$\text{Expected Loss} = \text{PD} \times \text{LGD} \times \text{EAD}$$

→ Transition from exposure tracking to capital forecasting.

4. Early Warning Monitoring

Add time-to-default analysis to proactively flag at-risk borrowers.