Loan Default and Risk Analysis

Designing a Risk-Based Loan Approval Framework

Sector:
Finance (Banking & Lending)

Presented By :
Team-G17

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Why this matters?

1. **Loan defaults erode profitability** and increase capital charges, directly impacting bank performance and regulatory requirements

2. **Traditional approval rules miss hidden patterns** in applicant behavior, such as interactions between credit grade, DTI, and loan purpose

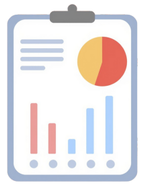
3. **Pre-approval risk screening** is critical to prevent losses before capital is deployed

Core Question

- **Which pre-approval applicant indicators predict loan default?**

Objective

- **Design a data-driven loan approval policy to reduce defaults through pre-approval risk assessment**



Raw Data

Cleaned Data

Analytics Mart

Scope

• 15,000 records | 8 selected columns (pre-approval only)

Cleaning Steps

1. **Removed duplicates** based on loanID
2. **Imputed null values** using median/mode
3. **Standardized grades** (A–G), home ownership categories, and loan purposes
4. **Created Default Flag** (Charged Off = 1, Fully Paid = 0)

Validation Checks

1. **No missing loan IDs:** All records have unique identifiers
2. **No negative loan amounts:** All amounts are positive values
3. **Valid grades A–G:** All credit grades fall within expected range
4. **Valid status categories:** Only Fully Paid, Charged Off, or Current
5. **Valid home ownership:** RENT, OWN, or MORTGAGE only

Total Loans:

14,699

Default Rate:

14.88%

Average Income:

75,031

Average DTI:

18.8193

Average Loan Amount:

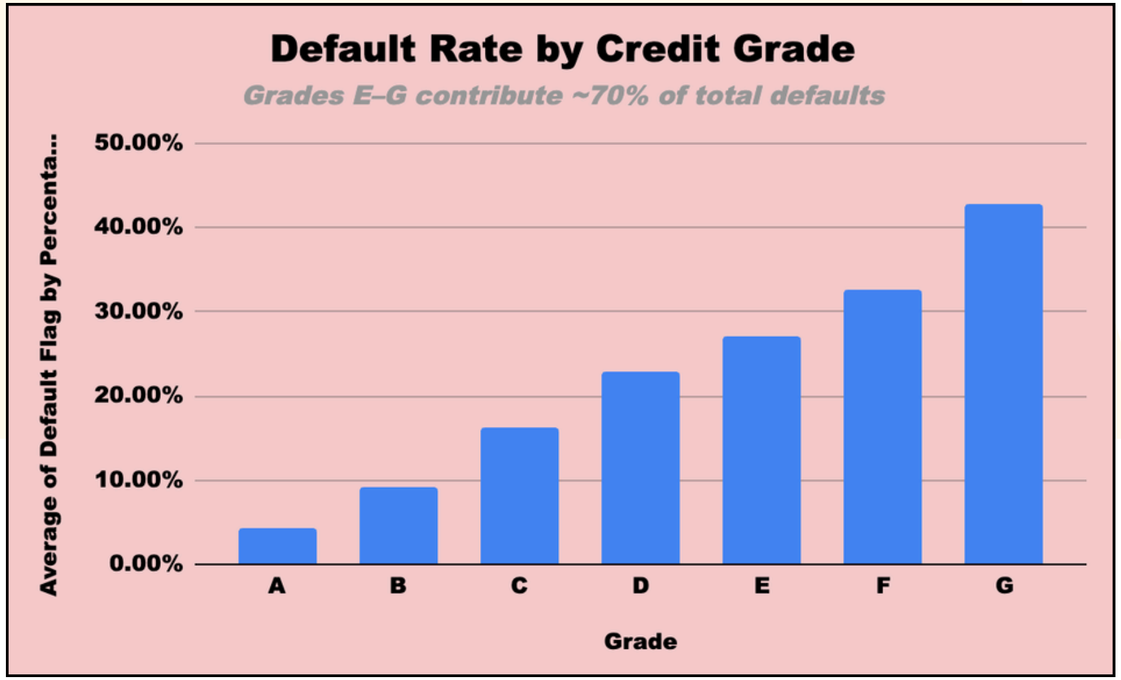
15,023

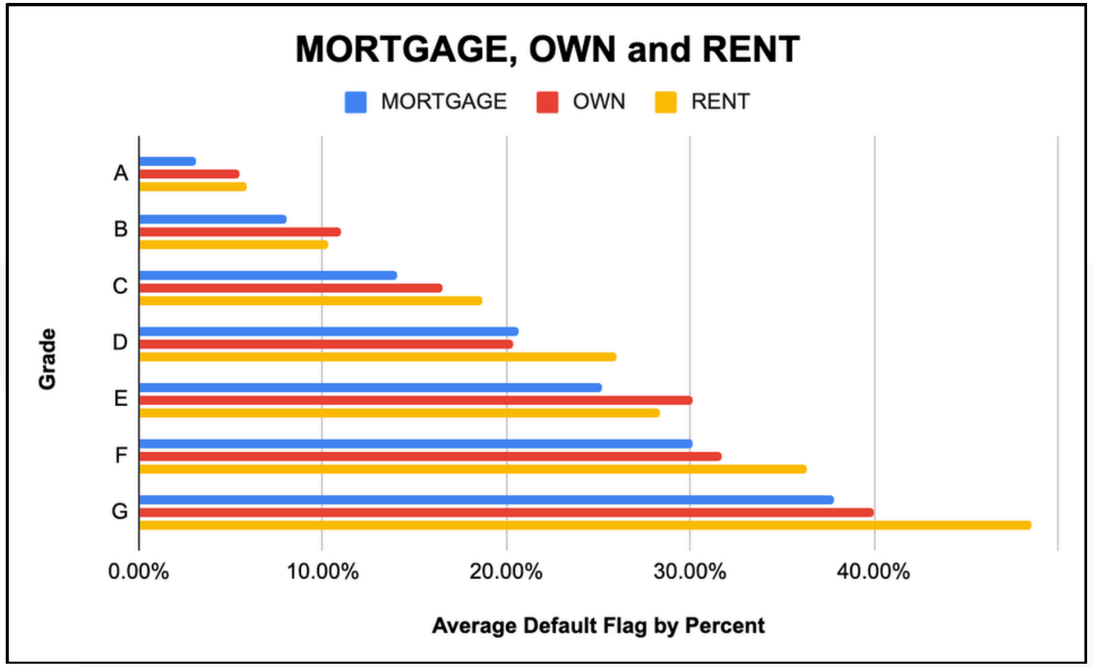
Average Risk Score:

9.114701

Key Insights
(EDA Findings)

Lower credit grades show exponentially higher default risk Grade G defaults at 41.2% vs Grade A at 5.3%





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Key Insights
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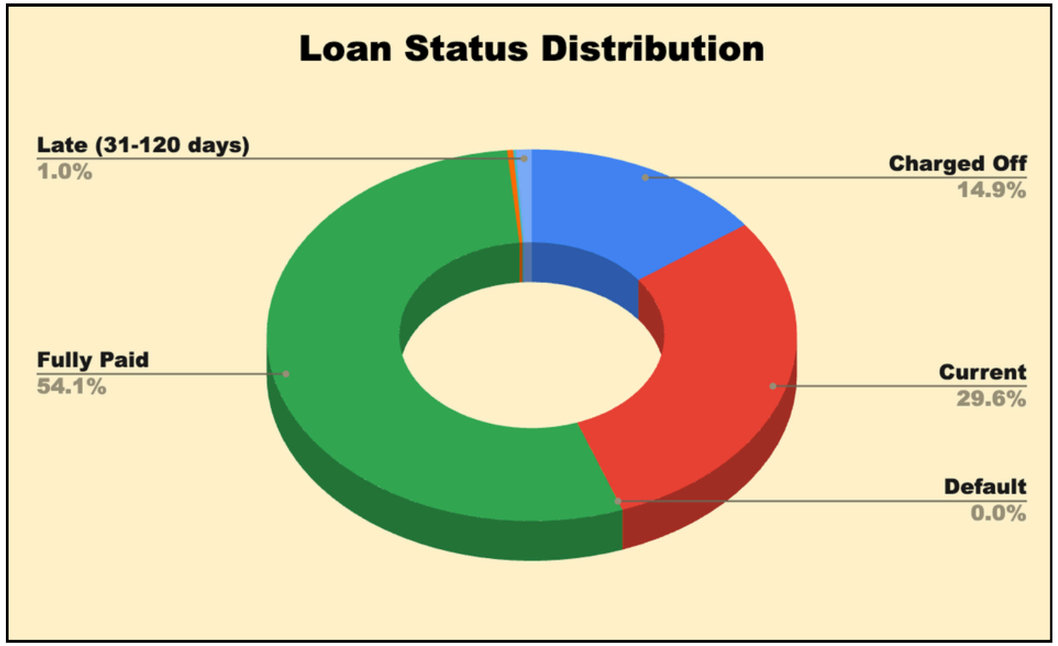
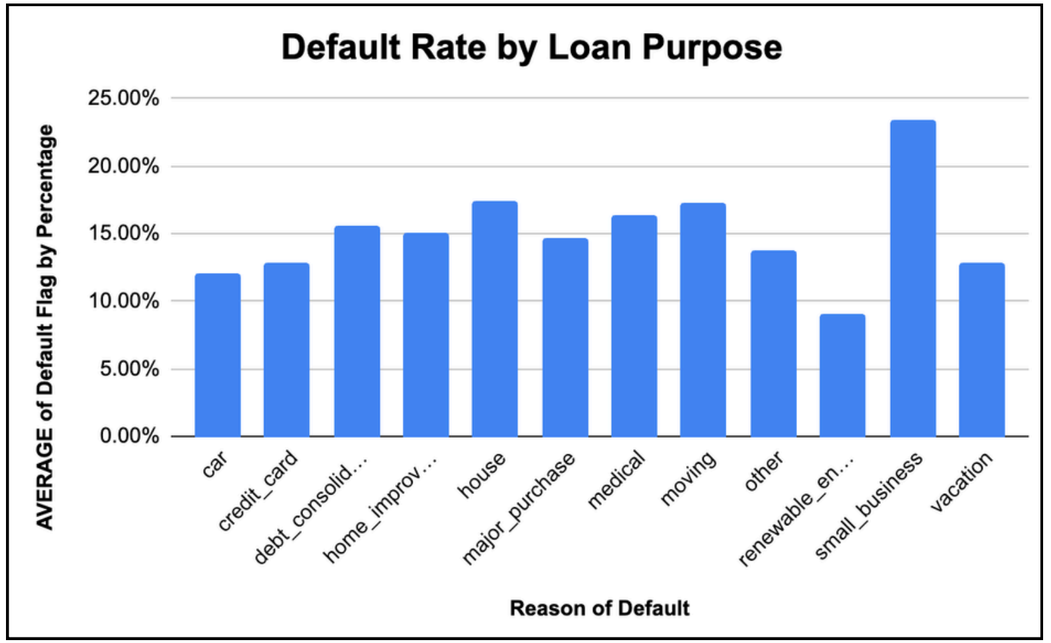


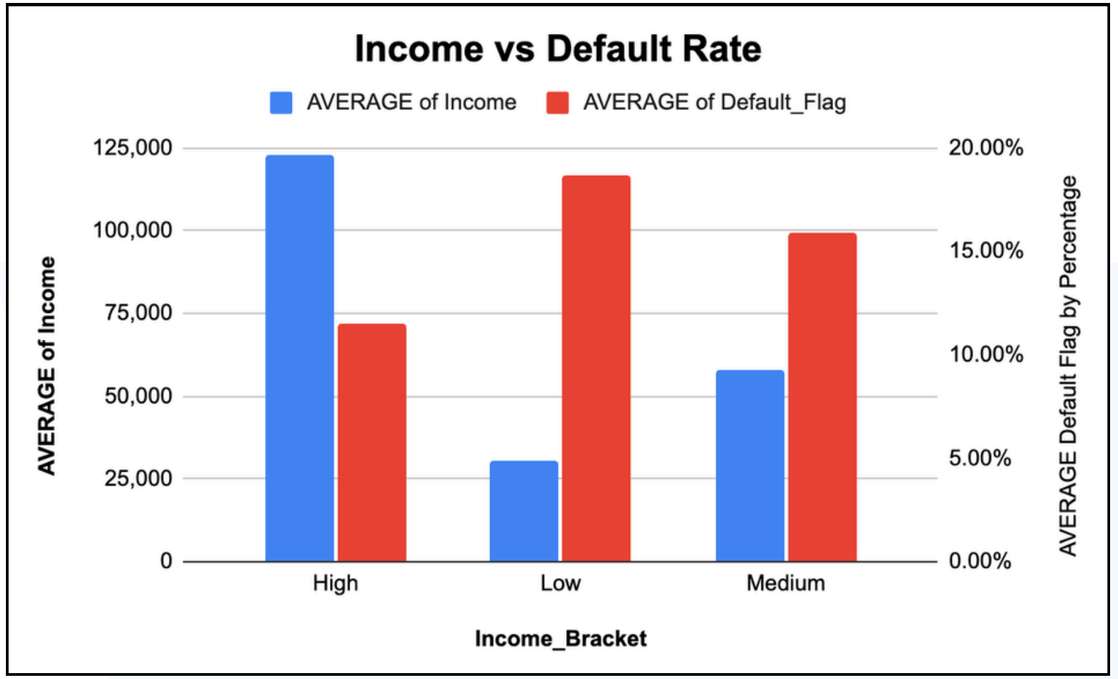
Fully paid loans dominate (54.1%), current loans follow (29.6%), and charged-off cases are 14.9% showing strong overall repayment.

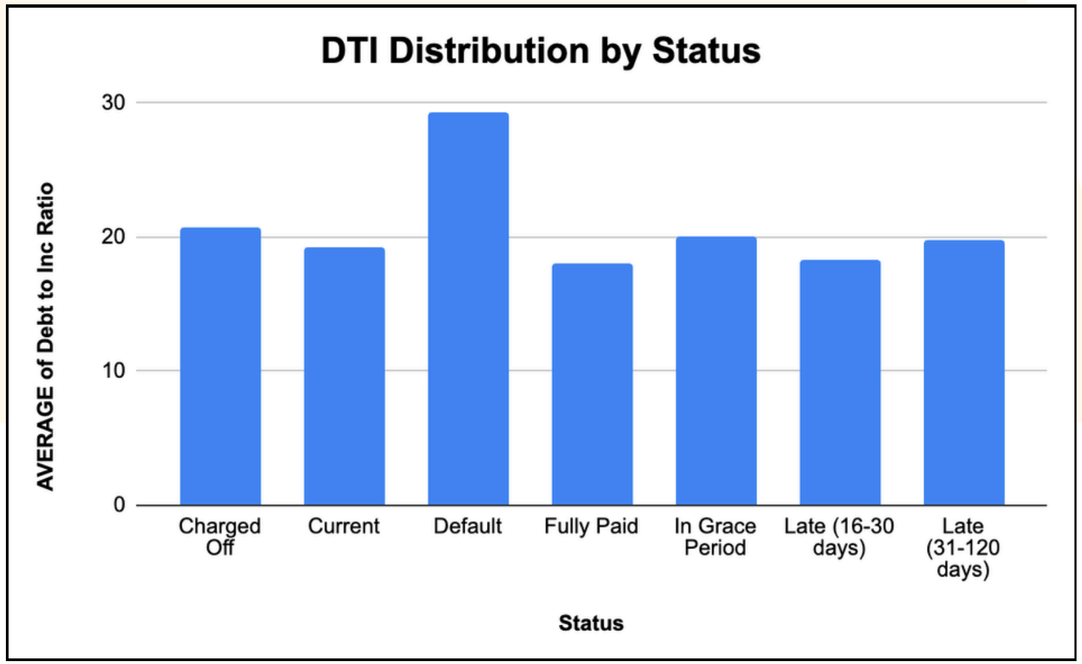
Small business loans show the highest default rate (~23%), while renewable energy loans are the lowest (~9%) indicating business lending carries comparatively higher risk.



Key Insights
(EDA Findings)

Default risk decreases as income rises low-income borrowers show the highest default rate (~18%), while high-income borrowers have the lowest (~11%).





Defaulted loans have the highest average DTI (~29%), while fully paid and current loans show lower DTI (~18–19%) indicating higher debt burden strongly correlates with default.

1.

Action

Introduce stricter approval criteria or partial auto-decline policy for Grades E–G applicants.

Linked Insight

Grades E–G contribute ~70% of total defaults and show sharply rising default rates (30–40%+).

Expected Impact

- 20–30% reduction in overall portfolio defaults
- Improved portfolio risk quality

2.

Action

Set DTI eligibility cap at 30% (or require additional collateral above this threshold).

Linked Insight

Defaulted loans show the highest average DTI (~29%), significantly higher than fully paid loans (~18%).

Expected Impact

- 10–15% reduction in high-leverage borrower defaults
- Lower charge-off ratios

3.

Action

Apply interest rate premiums for C–D grade borrowers instead of rejecting them outright

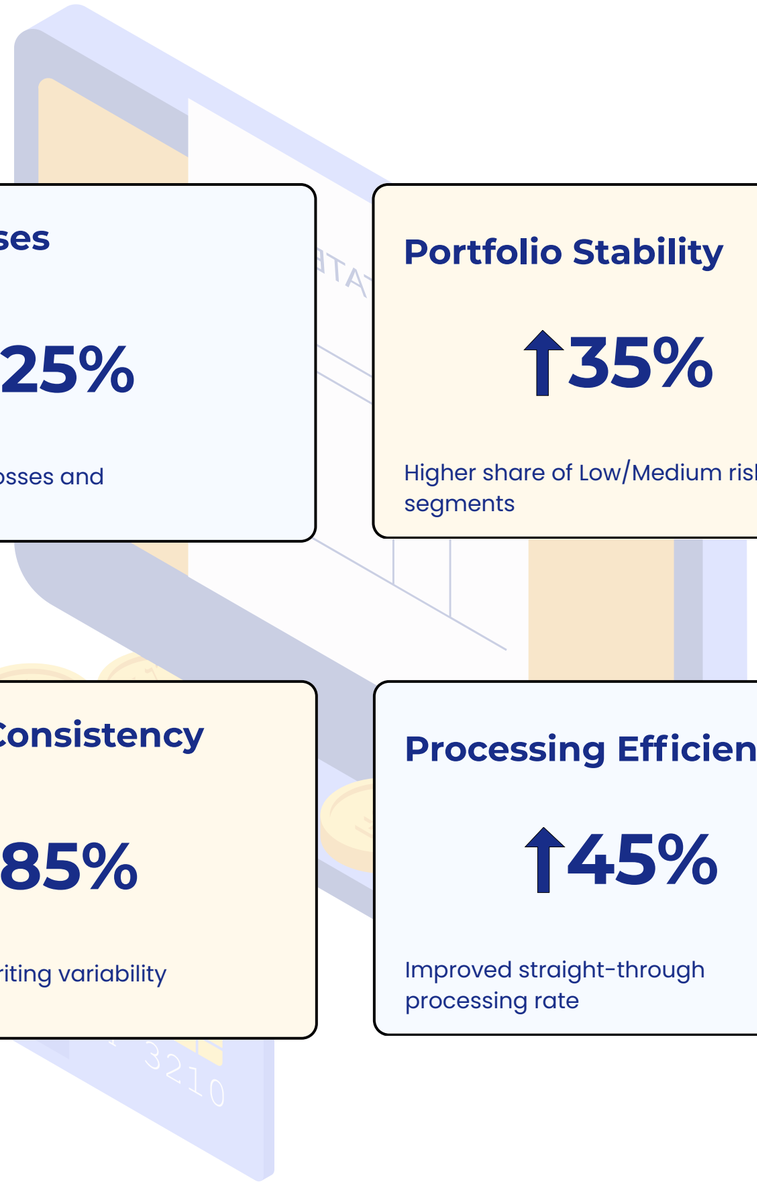
Linked Insight

Medium-risk borrowers show materially higher default rates than A–B but still represent large portfolio volume.

Expected Impact

- 20–30% reduction in overall portfolio defaults
- Maintained approval volume with better loss coverage

Impact & Business Value



Default Rate Reduction

20-30%

Expected reduction vs baseline through risk-based approvals

Credit Losses

↓25%

Lower expected losses and charge-offs

Portfolio Stability

↑35%

Higher share of Low/Medium risk segments

Risk-Adjusted Returns

↑2.8%

Improved ROE through better risk selection

Decision TAT

30-50%

Faster approval decisions via rule automation

Approval Consistency

↑85%

Reduced underwriting variability and bias

Processing Efficiency

↑45%

Improved straight-through processing rate

Audit Compliance

↑92%

Improved ROE through better risk selection

Current Limitations

1. **No Macroeconomic Variables**
   Analysis lacks external economic indicators (unemployment, GDP, interest rates) that influence default cycles

2. **No Real-Time Behavioral Scoring**
   Static pre-approval data only; missing post-approval behavioral patterns and payment history signals

3. **Historical Dataset Bias**
   Retrospective data may not reflect current market conditions or emerging risk patterns

Future Roadmap

1. **Integrate Credit Bureau & Alternative Data**
   Incorporate FICO scores, credit inquiries, payment history, and alternative data sources (utility bills, rent payments)

2. **Implement Real-Time Underwriting System**
   Deploy API-based decisioning platform with instant risk scoring, automated approvals, and dynamic pricing

3. **Add Economic Cycle Stress Testing**
   Simulate portfolio performance under recession, inflation, and rate shock scenarios for capital adequacy planning