Credit Risk Analysis and Loan Default Pattern Identification

FINANCIAL ANALYTICS / CREDIT RISK MODELING

TEAM MEMBERS:

SHOURYA, ANIMESH, PUNIT, RACHIT, PRAKHAR, DEV

Context

Building & Problem Statement

SECTOR CONTEXT

- CONSUMER LENDING ENABLES ACCESS TO CREDIT FOR EDUCATION, MEDICAL, AND PERSONAL NEEDS.
- HOWEVER, INCREASING UNSECURED LENDING HAS LED TO RISING LOAN DEFAULTS, DIRECTLY IMPACTING PROFITABILITY AND PORTFOLIO STABILITY.
- DECISION-MAKERS: CREDIT RISK TEAMS, UNDERWRITING MANAGERS, AND LENDING POLICY TEAMS.

PROBLEM STATEMENT

- **DESPITE EXISTING CREDIT GRADES AND SCREENING MECHANISMS, LOAN DEFAULTS PERSIST DUE TO COMPOUNDED BORROWER-LEVEL RISK FACTORS THAT ARE NOT EVALUATED HOLISTICALLY.**

OBJECTIVE

- TO ANALYZE BORROWER DEMOGRAPHICS, FINANCIAL STRESS, CREDIT HISTORY, AND LOAN ATTRIBUTES TO IDENTIFY HIGH-RISK PROFILES AND REDUCE DEFAULT EXPOSURE.

Data Engineering

DATA SOURCE

- DATASET: CREDIT RISK DATASET (KAGGLE)
- RECORDS: 32,584 LOANS
- STRUCTURE: CROSS-SECTIONAL CONSUMER LOAN DATA

DATA CLEANING (KEY ACTIONS)

- REMOVED MISSING AND INVALID INTEREST RATE RECORDS
- HANDLED OUTLIERS IN AGE, INCOME, AND EMPLOYMENT LENGTH
- FIXED CALCULATION ERRORS AND INVALID LOAN-TO-INCOME RATIOS
- STANDARDIZED CATEGORICAL VARIABLES AND TARGET LABELS

KEY COLUMNS USED

- AGE, INCOME, EMPLOYMENT LENGTH
- LOAN AMOUNT, INTEREST RATE, LOAN-TO-INCOME RATIO
- LOAN GRADE, LOAN INTENT, HOME OWNERSHIP
- CREDIT HISTORY LENGTH, PRIOR DEFAULT INDICATOR
- LOAN STATUS ***(TARGET VARIABLE)***

KPI & Metrics Framework

KEY METRICS USED

- OVERALL DEFAULT RATE
- AVERAGE LOAN AMOUNT
- AVERAGE INTEREST RATE
- LOAN-TO-INCOME RATIO
- BORROWER AGE DISTRIBUTION

WHY THESE KPIS?

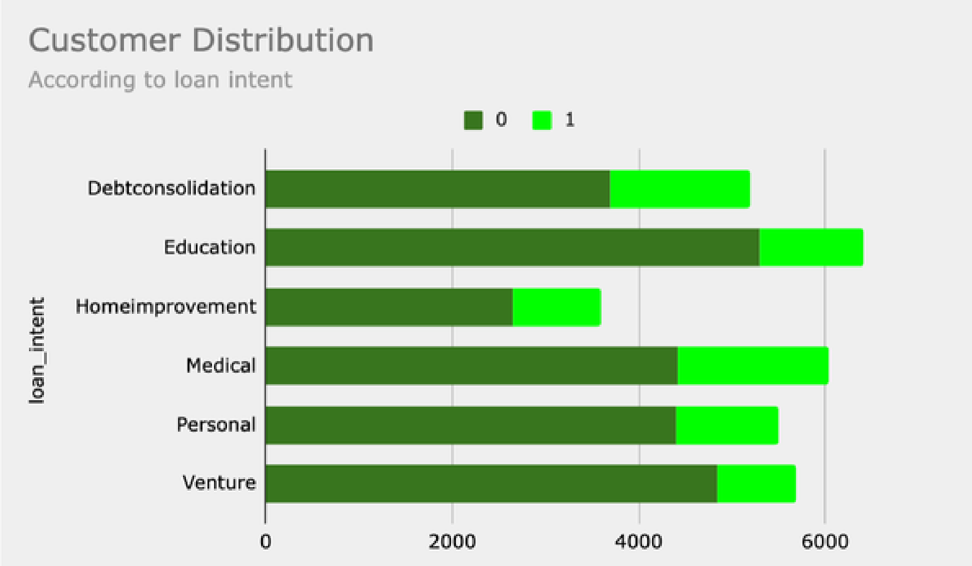
- DEFAULT RATE MEASURES PORTFOLIO RISK
- LOAN-TO-INCOME RATIO REFLECTS AFFORDABILITY STRESS
- INTEREST RATE CAPTURES RISK-BASED PRICING
- LOAN AMOUNT IMPACTS EXPOSURE SEVERITY
- AGE AND EXPERIENCE INDICATE FINANCIAL STABILITY

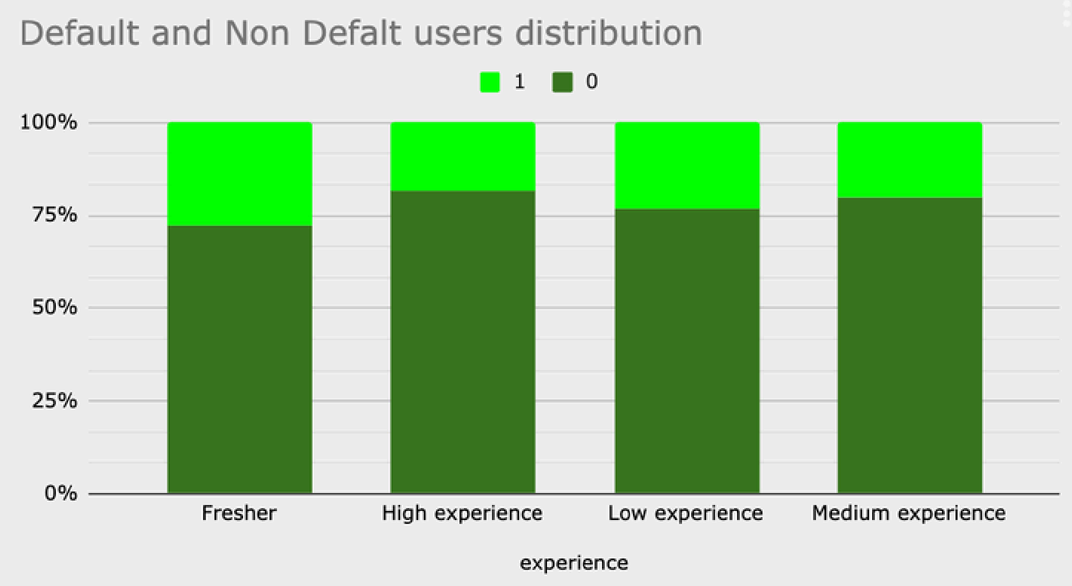
📌 ***THESE KPIS DIRECTLY SUPPORT CREDIT APPROVAL AND PRICING DECISIONS.***

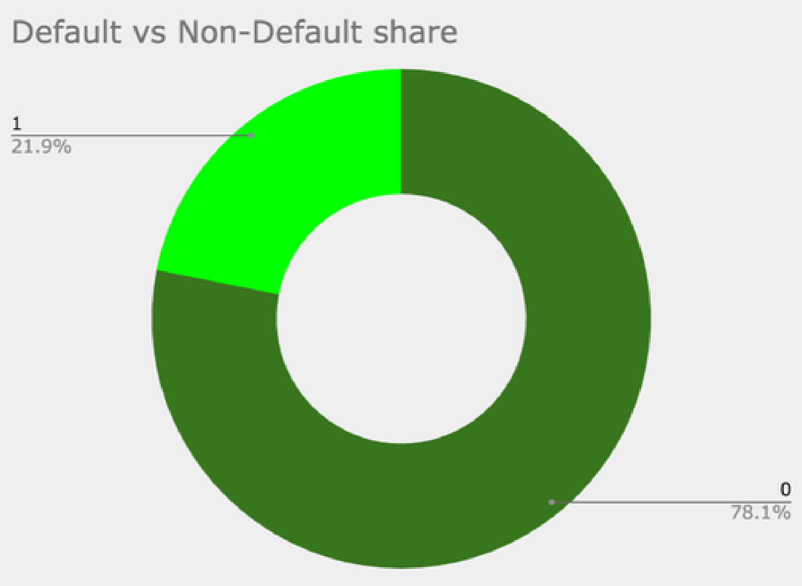
Customers	Loan Amount	Person income	Percent Income	Loan Interest Rate	Age
Total	Average	Average	Average	Average	Average
32411	9,876.69	67,531.05	0.18	11.19	28

Key Insights (EDA)

- OVERALL DEFAULT RATE IS ~22%, INDICATING MODERATE PORTFOLIO RISK.
- BORROWERS WITH HIGH LOAN-TO-INCOME RATIOS DEFAULT SIGNIFICANTLY MORE.
- DEFAULTED LOANS HAVE HIGHER INTEREST RATES, VALIDATING RISK-BASED PRICING.
- YOUNGER BORROWERS SHOW HIGHER DEFAULT FREQUENCY.
- MEDICAL AND PERSONAL LOANS CARRY HIGHER DEFAULT INCIDENCE.
- PRIOR DEFAULT HISTORY STRONGLY PREDICTS FUTURE DEFAULT BEHAVIOR.







Advanced Analysis

RISK SEGMENTATION

BORROWERS WERE SEGMENTED INTO LOW, MEDIUM, AND HIGH RISK BASED ON:

- LOAN-TO-INCOME RATIO
- CREDIT HISTORY LENGTH
- LOAN GRADE
- PRIOR DEFAULT BEHAVIOR

KEY FINDING

- DEFAULT PROBABILITY INCREASES NON-LINEARLY WHEN MULTIPLE RISK FACTORS OVERLAP.
- HIGH-RISK SEGMENTS SHOW BOTH:
  - HIGHER DEFAULT PROBABILITY
  - HIGHER AVERAGE LOAN EXPOSURE

📌 **THIS HIGHLIGHTS COMPOUNDED RISK, NOT ISOLATED DRIVERS.**

DASHBOARD WALKTHROUGH

EXECUTIVE VIEW

- PORTFOLIO KPIS
- DEFAULT VS NON-DEFAULT DISTRIBUTION
- AVERAGE INTEREST RATE COMPARISON

OPERATIONAL VIEW

- DEFAULT TRENDS BY LOAN GRADE AND INTENT
- RISK SEGMENT VS LOAN AMOUNT
- HOME OWNERSHIP AND EXPERIENCE-BASED RISK ANALYSIS

INTERACTIVITY

- FILTERS FOR LOAN GRADE, LOAN INTENT, HOME OWNERSHIP, AND EXPERIENCE TYPE
- ENABLES DYNAMIC RISK SEGMENTATION FOR DECISION-MAKERS

Investment &
Financial

Recommendations

INTRODUCE LOAN-TO-INCOME CAPS
REDUCE APPROVALS FOR BORROWERS EXCEEDING AFFORDABILITY THRESHOLDS.

REFINE GRADE-BASED PRICING
INCREASE PRICING DIFFERENTIATION WITHIN MID-RISK LOAN GRADES.

ENHANCED SCREENING FOR HIGH-RISK LOAN INTENTS
APPLY STRICTER VERIFICATION FOR MEDICAL AND PERSONAL LOANS.

EXPOSURE CONTROL FOR HIGH-RISK SEGMENTS
CAP LOAN AMOUNTS WHERE MULTIPLE RISK FACTORS COEXIST.

MULTI-FACTOR RISK APPROVAL MATRIX
COMBINE DEMOGRAPHIC, FINANCIAL, AND CREDIT SIGNALS IN APPROVAL LOGIC.

Impact & Value

ESTIMATED IMPACT

- A 10% REDUCTION IN HIGH-RISK LOAN APPROVALS CAN LEAD TO:
  - 3–5% REDUCTION IN DEFAULTS
  - IMPROVED PORTFOLIO STABILITY
  - BETTER CAPITAL UTILIZATION

BUSINESS VALUE

- REDUCES CREDIT LOSSES
- IMPROVES UNDERWRITING QUALITY
- SUPPORTS SUSTAINABLE LENDING GROWTH

📌 **ENABLES DATA-DRIVEN RISK CONTROL WITHOUT SACRIFICING SCALE.**

Limitations & Next Steps

LIMITATIONS

- NO TIME-SERIES REPAYMENT BEHAVIOR
- NO MACROECONOMIC INDICATORS
- NO TRANSACTIONAL OR BEHAVIORAL DATA
- CROSS-SECTIONAL ANALYSIS ONLY

NEXT STEPS

- MACHINE LEARNING-BASED DEFAULT PREDICTION MODELS
- EXPLAINABLE AI FOR CREDIT DECISIONS
- INTEGRATION OF MACROECONOMIC VARIABLES
- REAL-TIME RISK MONITORING DASHBOARDS