

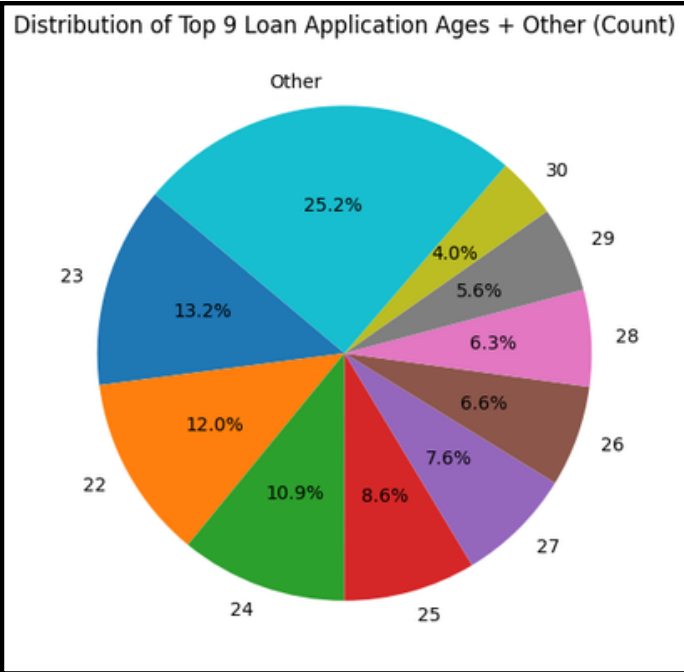
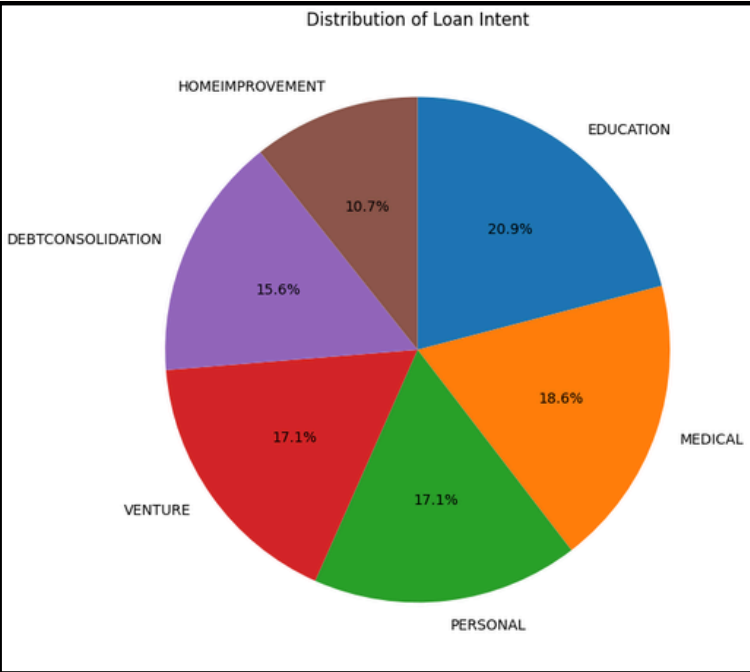
USE CASE II

LOAN APPLICATION

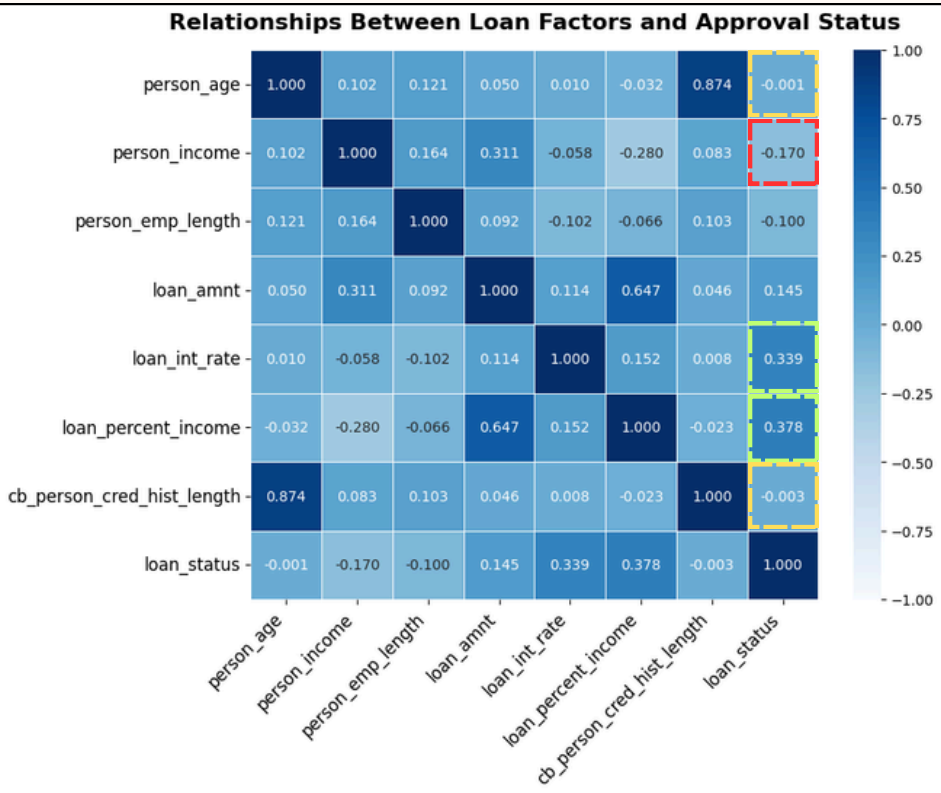
Personal Information

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Services needed	REVIEW		SUBJECT		REVIEW		

How can we leverage the loan-approval.csv dataset to optimize loan approval and rejection policies?



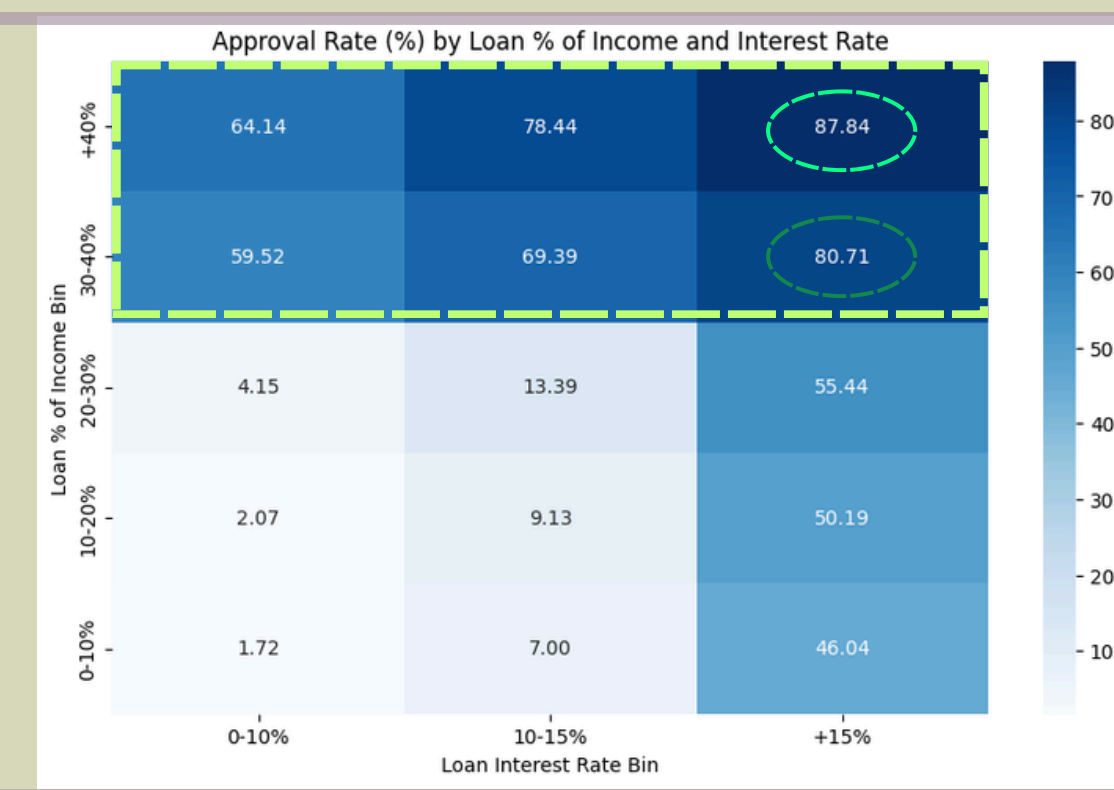
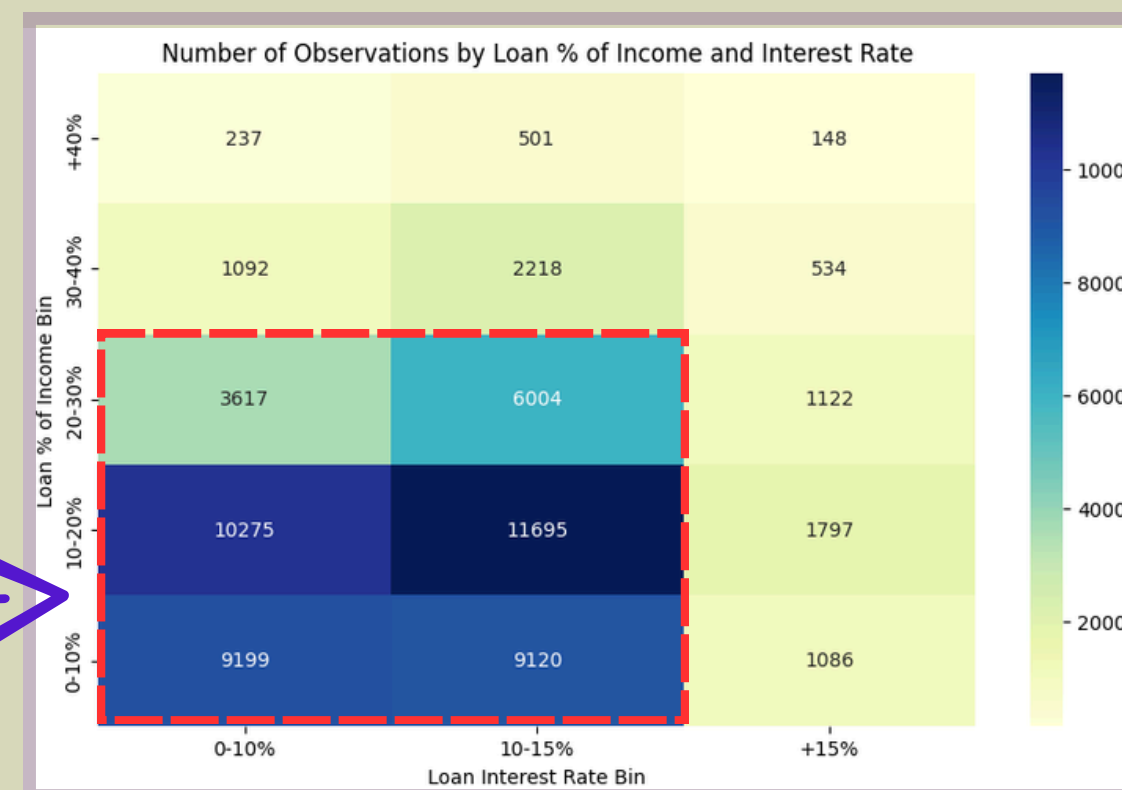
- The dataset contains 13 columns, including 7 integer columns, 2 float columns, and 4 categorical columns.
- The dataset contains **58,645** loan applications. There are no duplicate requests, as each application has a **unique ID**.
- Out of all applications, **14.24% were approved**, while **85.76% were rejected**.
- There is a wide age distribution in the dataset, with the most significant **age group being 22-25, accounting for nearly 45% of the dataset**.
- There are six loan purposes, but **the most common loan requests are for education (20.9%)**.



- There is a **positive** correlation (0.38) between loan approval and the percentage of income allocated to **repayment** -This means that borrowers who dedicate a larger portion of their income to loan repayment have a higher chance of approval.
- There is a **positive** correlation (0.34) between loan approval and high interest rates - The bank approves more loans with high interest rates.
- There is a **negative** correlation (-0.17) between income and loan approval - This suggests that people with higher incomes tend to get rejected more often.
- There is a **very weak** correlation (close to 0) between credit history length, age, and loan approval - This means that credit history length and age do not play a significant role in the bank's loan approval decisions.

Loan Approval: Between a High-Risk Profile and a Safe Profile

From the chart, it appears that approved loan applications are mainly concentrated in the area where both the interest rate and the percentage of income allocated to the loan are high. I wanted to investigate whether this is driven by one factor alone or by the combination of both.



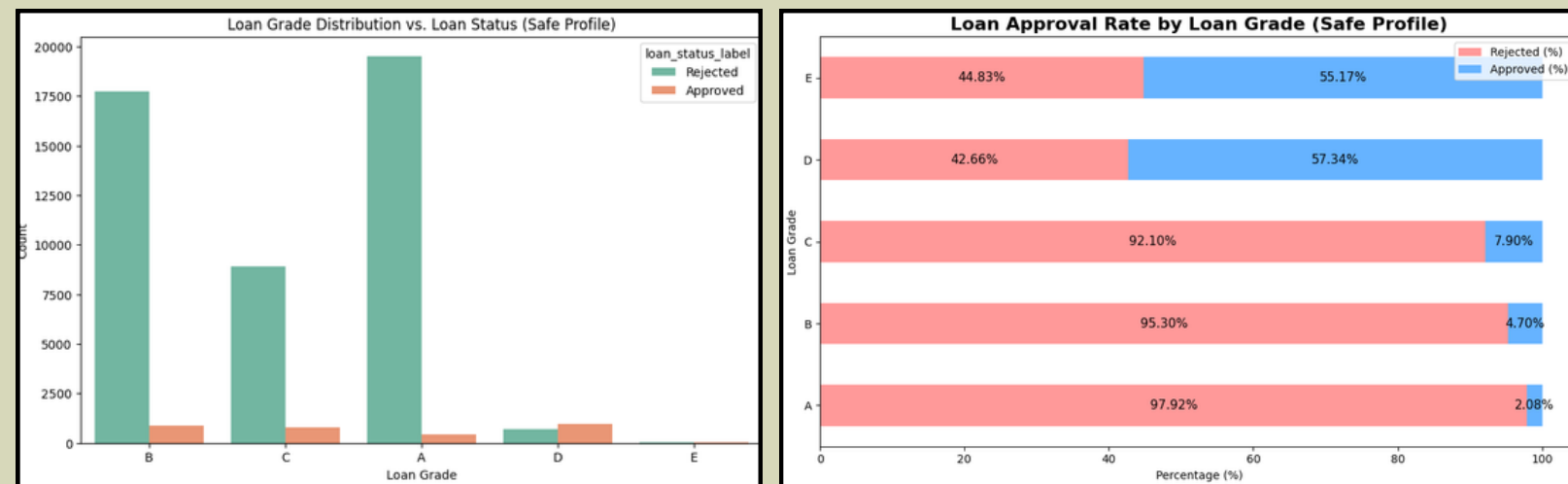
From the chart, it appears that **approved loan applications are mainly concentrated in the area where both the interest rate and the percentage of income allocated to the loan are high**. I wanted to investigate whether this is driven by one factor alone or by the combination of both.

- The majority of loan applications fall within the interest rate range of 0-15% and the income allocation to repayment range of 0-30%. **However, approval rates within these ranges are relatively low.**
- **The highest approval rates** are observed when both the interest rate is above 15% and the percentage of income allocated to repayment exceeds 40%, with an approval rate of 87.84%, highlighting the combined importance of these two factors.
- Each factor separately increases approval chances:
 - High interest only (above 15%) → 46.04% approval (even with low repayment income).
 - High repayment income only (above 40%) → 64.14% approval (even with low interest)..
- The bank favors loans with high interest or high repayment income, especially when both are combined.

Credit Rating Influence in Safe and High-Risk Profiles

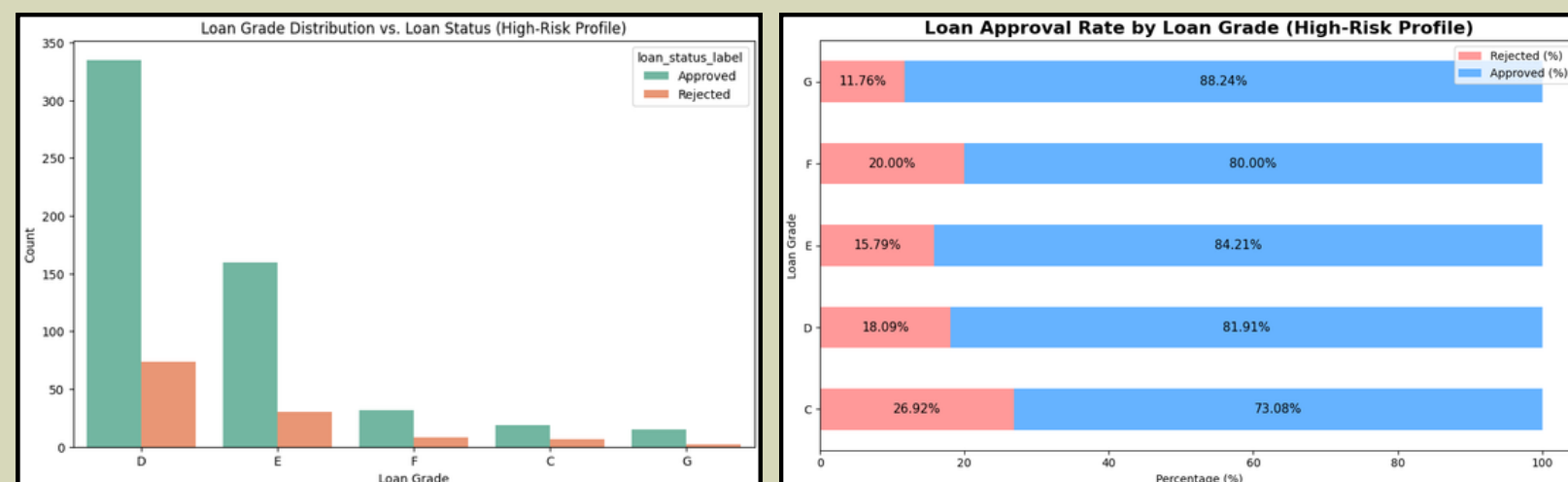
In the current dataset, I have identified two types of profiles -

- **High-Risk Profile:** Loan applications with an interest rate above 15% and a percentage of income allocated to the loan above 30%. This profile accounts for 682 observations and shows high approval rates.
- **Safe Profile:** Loan applications with an interest rate between 0–15% and a percentage of income allocated to the loan between 0–30%. This profile accounts for 49,910 observations and shows lower approval rates, despite high demand for such loans.



Safe Profile

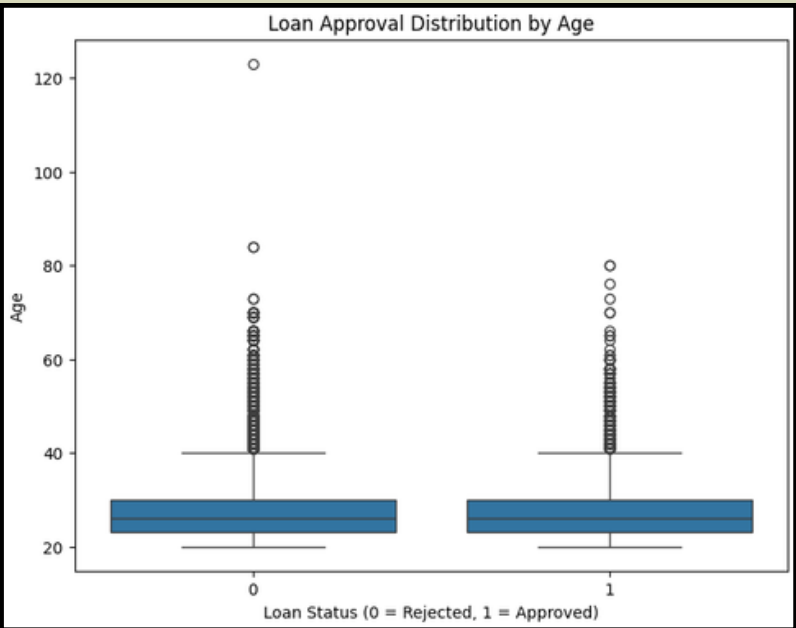
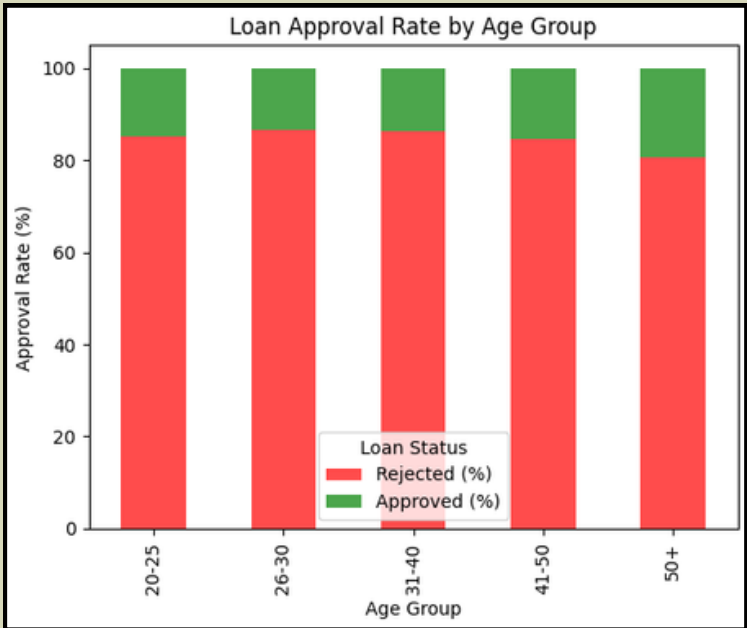
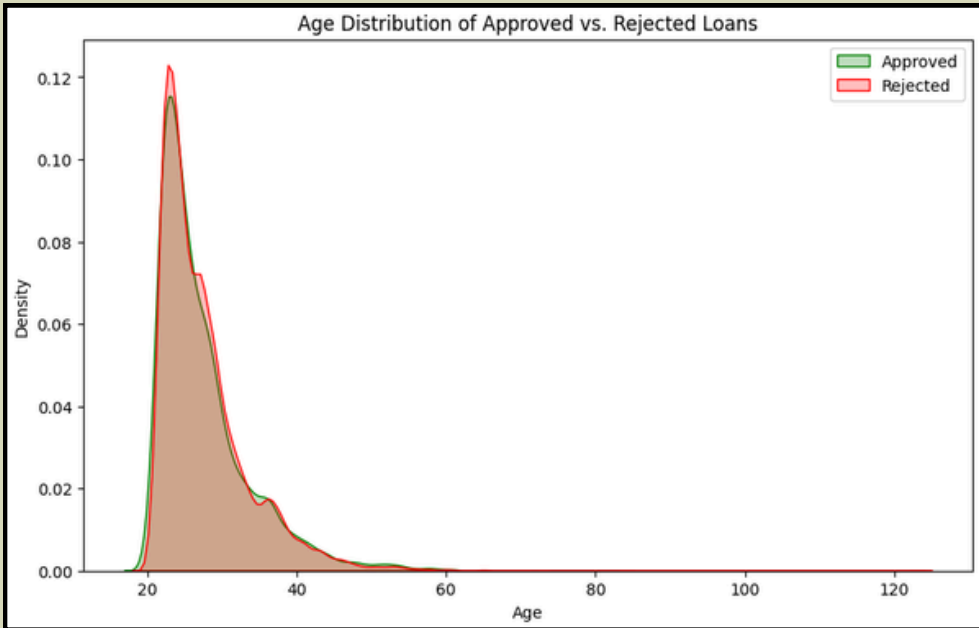
High-Risk Profile



- In the **Safe Profile**, borrowers with **high credit ratings (A, B, C)** have very **low approval rates**. In contrast, borrowers with **medium-low credit ratings (D, E)** receive **higher approval rates (57.34%, 55.17%)**.
- In the **High-Risk Profile**, where approval rates are generally higher, **all credit ratings range between C and G** – meaning there are no borrowers with high credit ratings (A and B). **The lowest rating (G) has the highest approval rate (88.24%)**.
- After observing in **Slide 2** that the correlation between credit rating and loan approval is **close to zero**, we can see that this trend remains unchanged **even after segmenting applicants into two profiles (Safe and High-Risk)**, which are based on a combination of variables such as interest rate and the percentage of income allocated to loan repayment.
- This reinforces the understanding **that the bank largely disregards credit history and instead prioritizes other factors, such as interest rate and income allocation to repayment, in its loan approval decisions.**

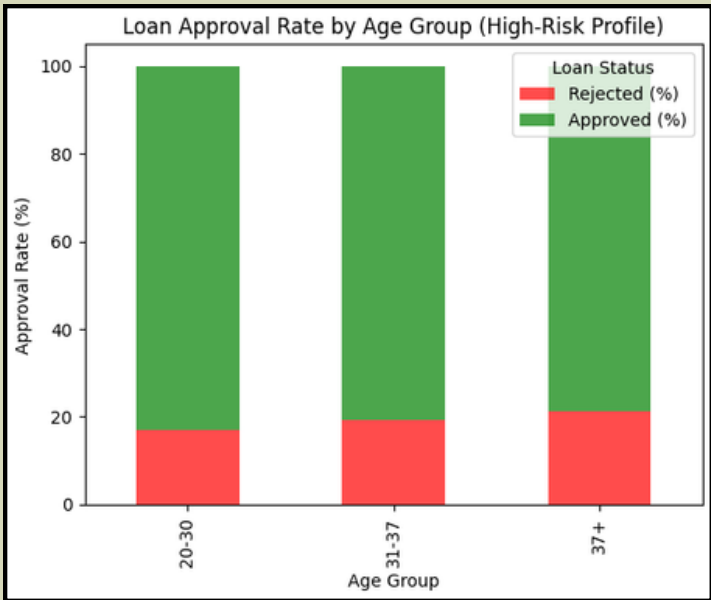
Does Age Affect Loan Approval?

Since the initial correlation analysis showed that age has an almost negligible impact on loan approval (correlation close to 0), I wanted to investigate whether this remains true when combined with factors that have a positive correlation with approval, such as interest rate and the percentage of income allocated to loan repayment



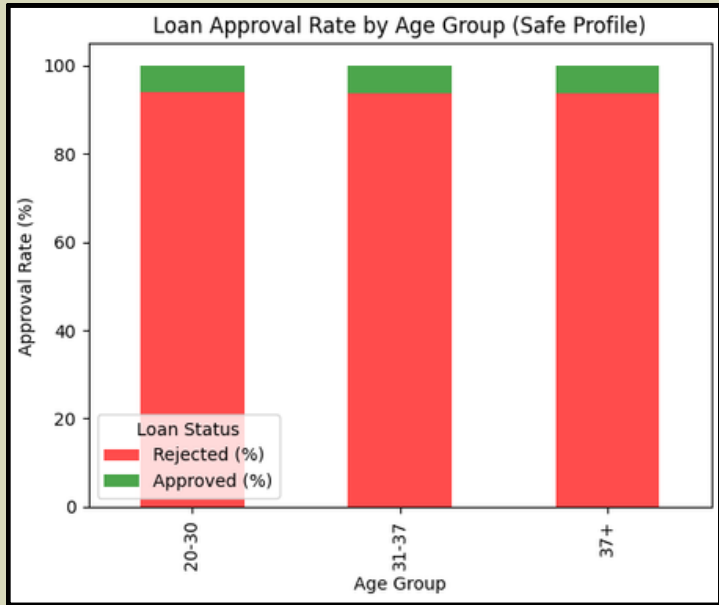
- Very low correlation between age and loan approval (-0.001), meaning age has almost no impact on the bank's decision-making.
- Most loan applicants are young, primarily between the ages of 20-30.
- No significant differences between age groups, but applicants aged 50+ receive slightly more approvals compared to other groups.
- The median age of approved and rejected applicants is nearly identical, reinforcing that age does not play a significant role in loan approval decisions.

High-Risk Profile



- Most loan applications in the High-Risk Profile come from young applicants aged 20-30, accounting for 75% of all applications (511 applications).
- The approval rate in the High-Risk Profile is high at 82% (561 applications approved), with no significant differences between age groups.
- The correlation between age and loan approval in the High-Risk Profile is -0.025, meaning that even when combining the key variables of the High-Risk Profile (income percentage allocated to loan repayment and interest rate), age remains an insignificant factor in the bank's decision-making process

Safe Profile



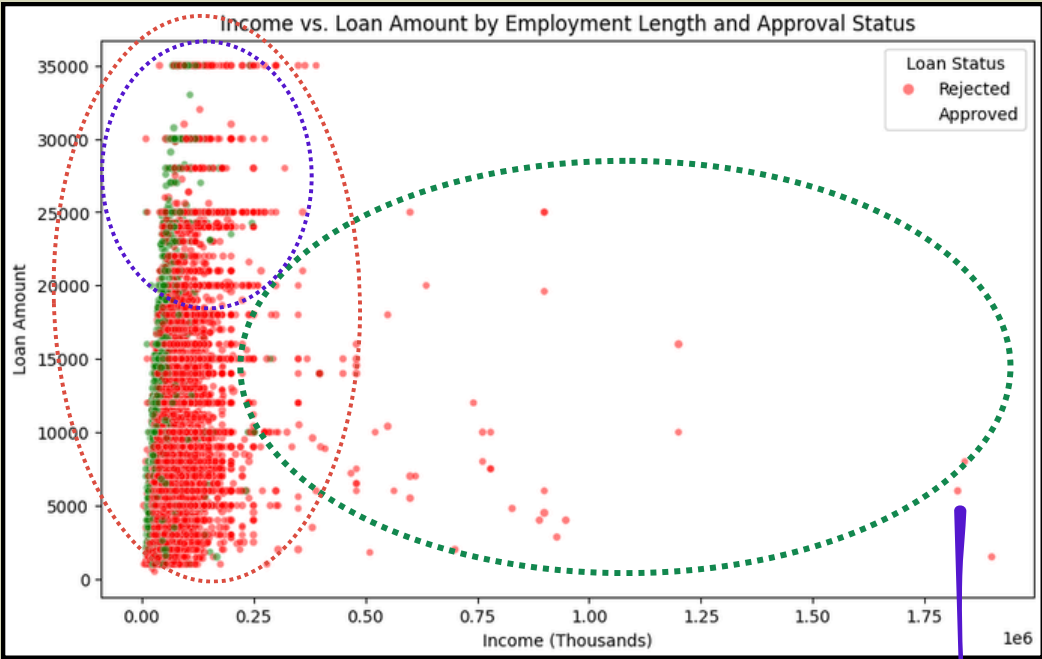
- In the Safe Profile, most loan applications come from applicants aged 20-30, accounting for 74% of all applications.
- In this profile, the majority of loan applications are rejected, with 93.9% of requests being denied.
- The correlation between age and loan approval in the Safe Profile is 0.08, meaning that even when considering the defining variables of this profile (percentage of income allocated to loan repayment and interest rate), age is not a significant factor in the bank's decision-making process.

Age does not have a significant impact on loan approval – the correlation remains close to zero, even after segmenting applicants into safe and high-risk profiles, indicating that the bank primarily focuses on other financial factors in its decision-making process.

Impact of Income, Loan Amount, and Employment Stability on Loan Approval

Given the negative correlation between income and loan approval, I wanted to examine how the combination of income with other factors, such as loan amount and employment stability, impacts the approval process. Specifically, I investigated whether financially stable applicants tend to request higher loan amounts and whether this affects their likelihood of approval.

- **Income Range:**
 - The highest recorded income is \$1.9 million per year, while the lowest is \$4,200 per year.
 - Median income: \$58,000
- **Loan Requests:**
 - The highest requested loan amount is \$35,000, while the lowest is \$500.
 - Median loan request: \$8,000 (Most requests are for relatively small amounts).
- **Employment Experience:**
 - Median employment length: 4 years (50% of applicants have 4 years or less of work experience).



- **The majority of data points are concentrated on the left side of the graph**, indicating that most loan applicants have **low to moderate income levels**.
- Despite the expectation that higher-income borrowers would receive **more approvals**, this is not the case. This finding aligns with the **negative correlation** observed earlier between income level and loan approval.
- Loan requests ranging from **\$20,000 to \$35,000** appear across **all income levels**, suggesting that loan amount alone is **not restricted** to specific income groups.

Financial Stability Classification

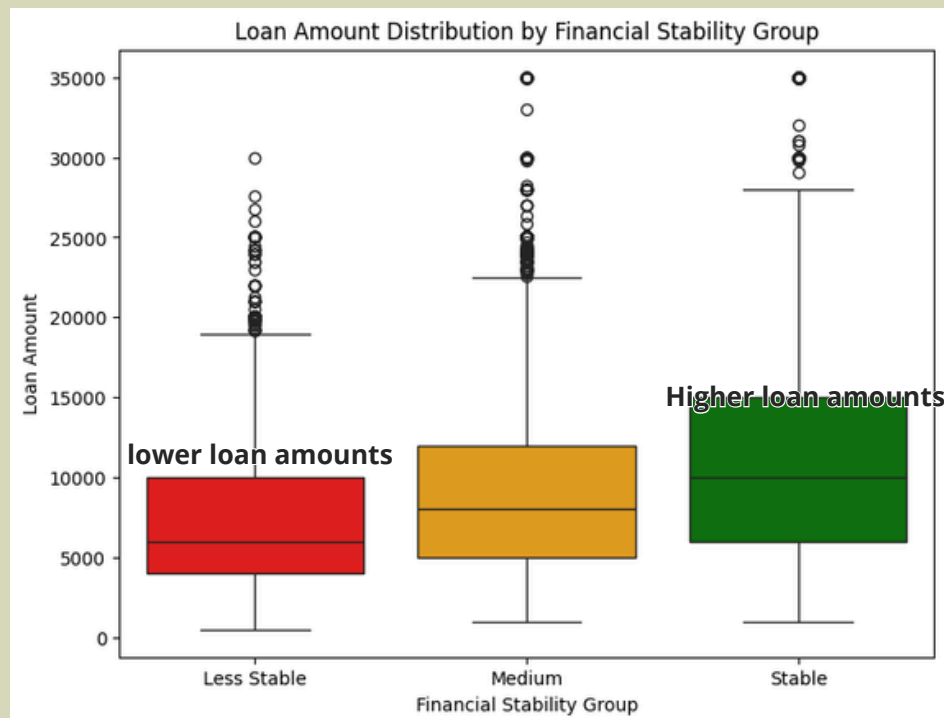
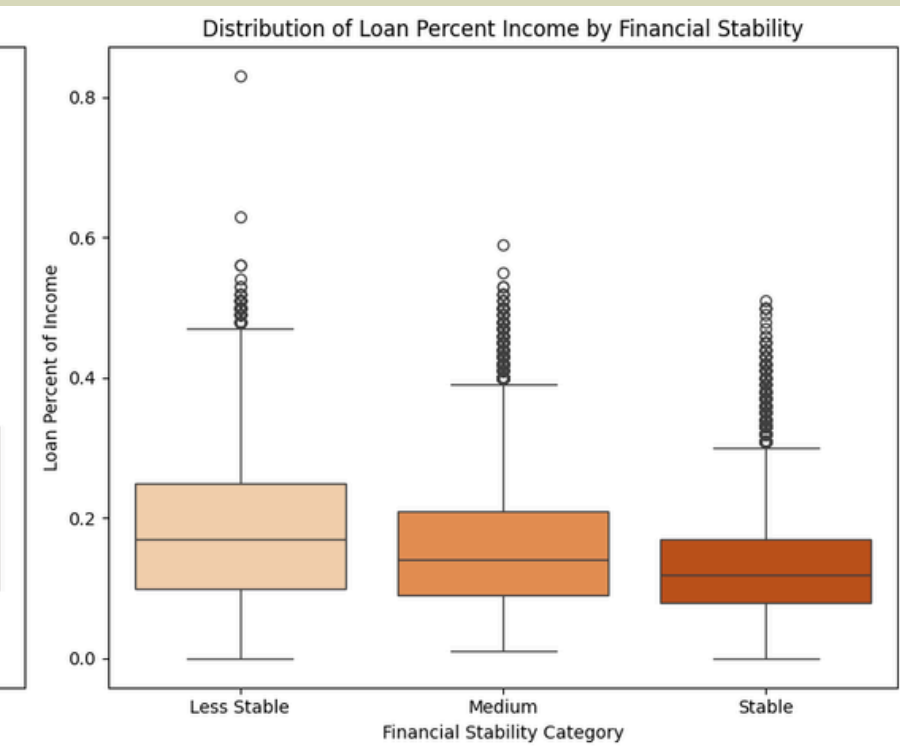
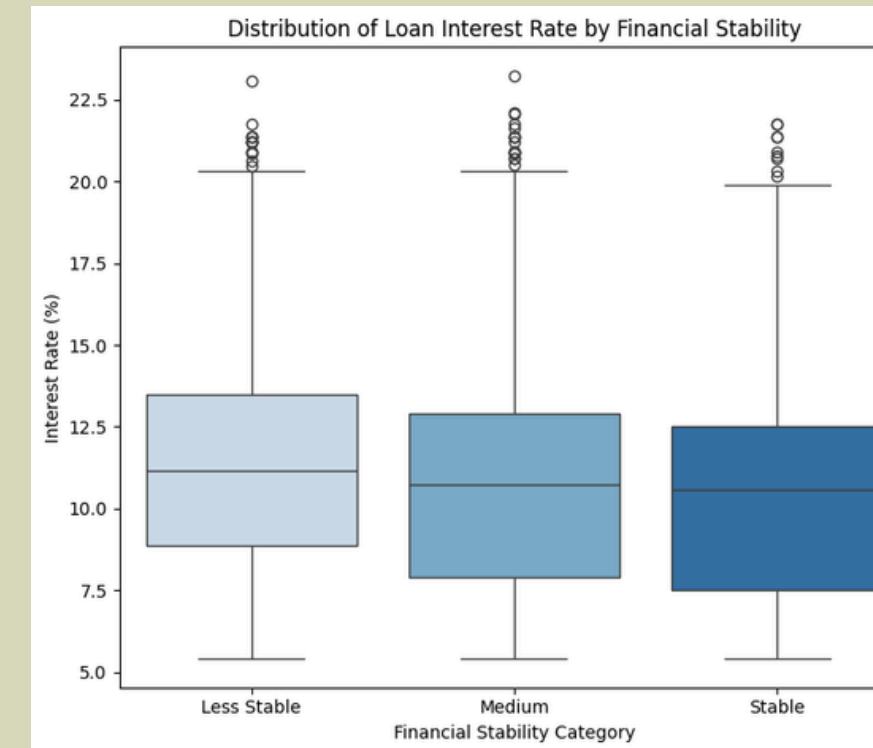
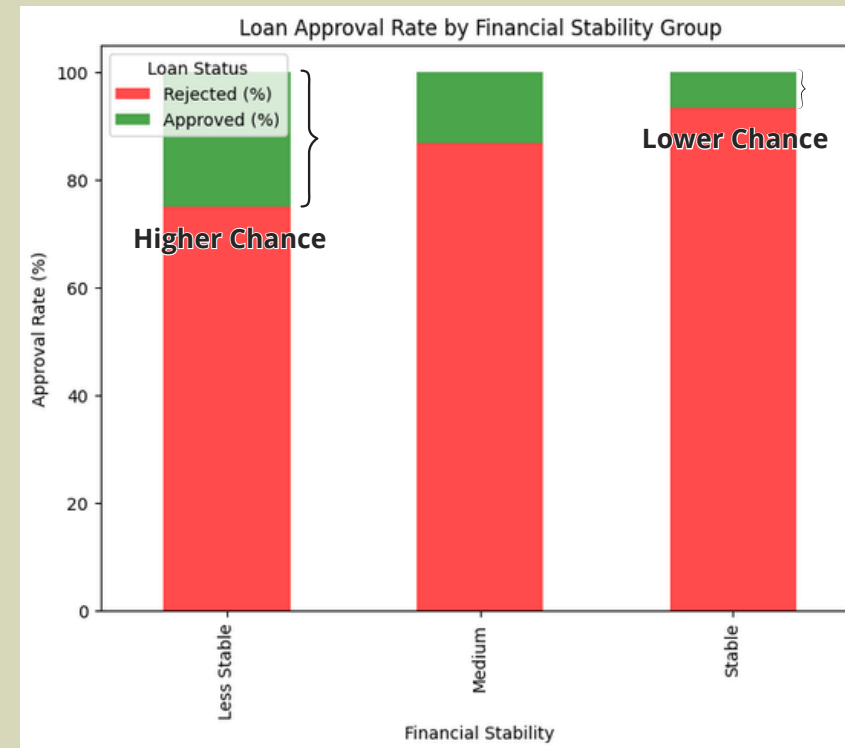
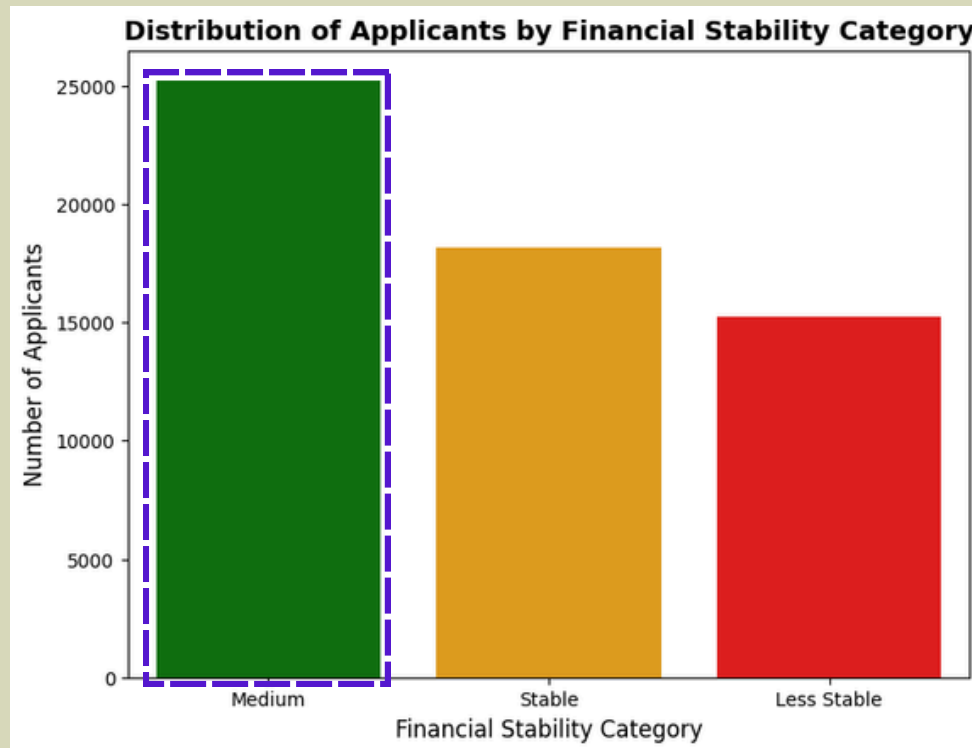
To better understand the impact of **income and employment experience** on loan approvals, I categorized applicants into **three financial stability groups** based on their **annual income and years of work experience**.

Since **income distribution is highly skewed due to a small number of extremely high-income applicants**, I used the **median** instead of the **average** as a more representative measure. The median provides a **more balanced threshold**, reducing the influence of outliers and better reflecting the financial situation of most applicants.

Financial Stability Groups:

- **Stable:** Applicants with **both** an income **above the median** and work experience **above the median** (i.e., **above \$58K and at least 4 years of experience**).
- **Medium:** Applicants who meet **only one of the two criteria** (**either** income above the median **or** work experience above the median).
- **Less Stable:** Applicants with **both** income **below the median** and work experience **below 4 years**.

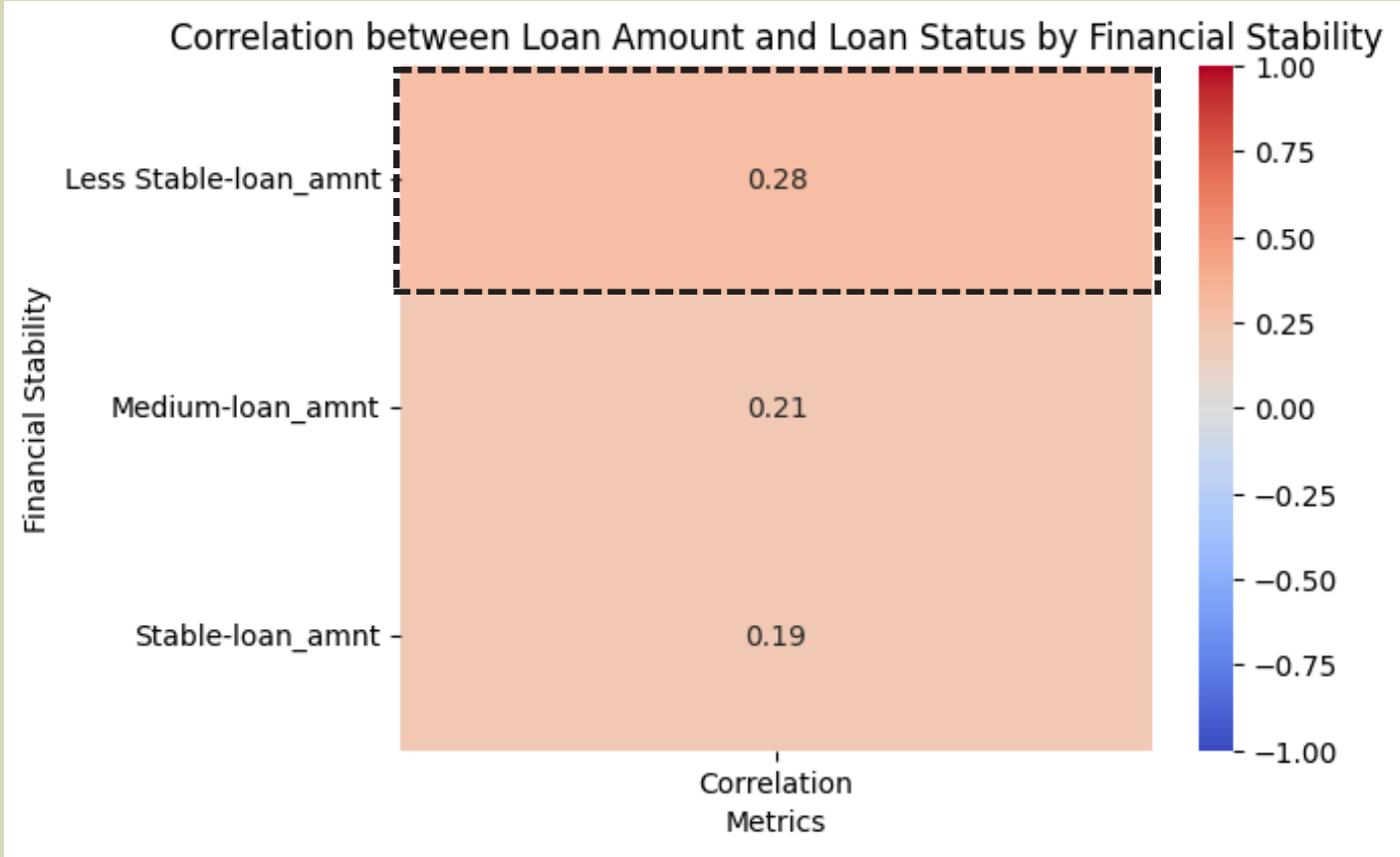
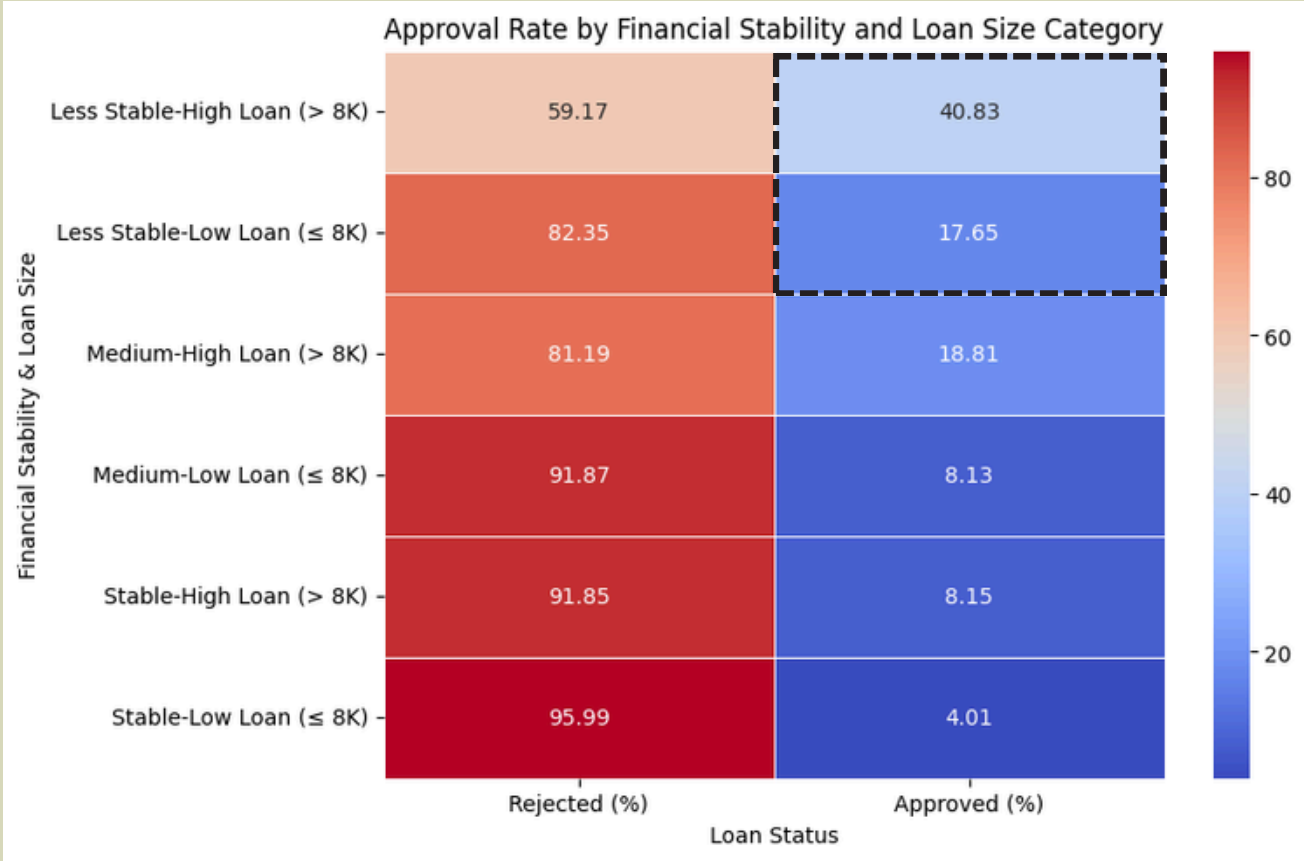
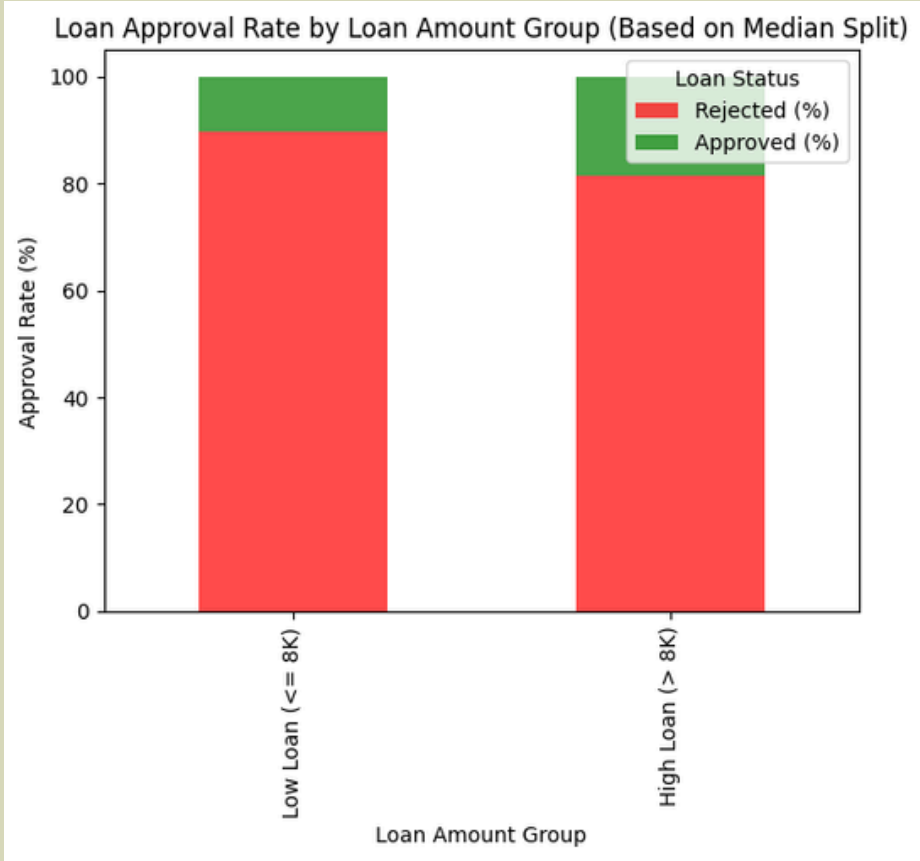
The Relationship Between Financial Stability and Loan Approvals



- Most applicants fall into the "**Medium**" (Moderate Stability) category, followed by "**Stable**", and lastly "**Less Stable**" applicants.
- **The more financially stable the applicant, the lower their chances of loan approval!** This aligns with previous findings—banks do not necessarily favor applicants with higher income and extensive work experience.
- **Less stable applicants pay higher interest rates and allocate a larger percentage of their income toward loan repayment.**
- **More stable applicants request higher loan amounts.**

- Financial stability does not guarantee loan approval.
- More stable borrowers request higher loan amounts, yet their approval rates are lower.
- Banks are willing to approve loans for less stable applicants but under less favorable conditions (higher interest rates, higher income percentage allocated to repayment).

How Do Financial Stability and Loan Amount Impact Approval Chances?



- The median loan amount is \$8,000.
- **30,694 loans** are at or below the median, while **27,951 loans** are above the median.
- **Only 10.4% of loans at or below the median are approved**, compared to **18.5% of loans above the median** – a significant gap indicating that banks tend to approve higher loan amounts more frequently.
- **Higher loan amounts improve approval chances for less stable borrowers:**
 - Less stable borrowers requesting **higher loans (>8K)** were **approved at a rate of 40.83%**, compared to **only 17.65% for lower loan amounts**.
 - Even for lower loan amounts, **less stable borrowers still enjoy higher approval rates (17.65%)** compared to medium or highly stable applicants, whose approval rates are **less than half of that**.
- **Highly stable borrowers with high income face higher rejection rates** – even for smaller loan amounts.

The bank tends to approve larger loans across all customer groups, but primarily for less stable borrowers, likely due to the profitability potential from higher interest rates. Even among stable borrowers, the approval rate for **larger loans is twice as high** compared to smaller loans. However, **compared to less stable borrowers, they are still rejected at higher rates**.

Insights

- **The bank's approval policy focuses on risk compensation:** The bank tends to approve loans for customers considered "risky," but to offset this risk, it charges them higher interest rates. However, this risk is calculated – most borrowers in the high-risk profile request smaller loan amounts, reducing the bank's overall exposure.
- **Higher income and longer employment history do not increase approval chances – quite the opposite:** Financially stable borrowers tend to request higher loan amounts, yet their approval rate is relatively low. The bank appears to prefer applicants with lower incomes, likely due to the higher profitability potential from loans granted under stricter conditions.
- **Credit rating and age are not significant factors in loan approval decisions:** Despite expectations that credit history would play a key role in loan approvals, even applicants with low credit scores receive approvals under certain conditions. Additionally, the applicant's age has little to no impact, even though financial logic might suggest that older applicants could face more difficulties securing loans due to potential repayment risks.
- **The Impact of Loan Amount on Approval Rate by Financial Stability:** The bank tends to approve larger loans across all customer groups, but primarily for less stable borrowers. Although less stable borrowers generally request smaller loans, when they apply for higher amounts, their approval rate jumps significantly (40.83%). Medium and stable borrowers also experience a slight improvement in approval rates for larger loans, but their approval rates remain significantly lower compared to less stable borrowers. It appears that banks see less stable borrowers with larger loans as a high-profit opportunity, leading to higher approval rates for this group.

The analysis shows that the bank does not operate based on traditional credit risk criteria but instead focuses on a combination of high interest rates, significant monthly repayments, and loan amounts to maximize profitability, even at the expense of approving loans for less stable borrowers

Recommendation

The analyzed bank focuses primarily on **high-risk borrowers**, leveraging high interest rates and repayment percentages to maximize profitability. However, for our bank, it is advisable to develop a **profitable loan track for more stable customers** as well. This segment represents a **large market opportunity**, and offering tailored loan products with competitive yet sustainable terms could attract financially stable borrowers while maintaining profitability.