

Bank Loan Performance Analysis & Risk Assessment

An End-to-End Data Analysis Project

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Executive Summary

This report details the findings of an end-to-end data analysis project on the bank's loan portfolio, encompassing over 38,000 loan records. The primary objective was to transform raw transactional data into an interactive and actionable Power BI dashboard to provide clarity on key performance indicators (KPIs), customer segments, and financial risk.

The analysis followed a rigorous methodology, beginning with data preparation and validation in a MySQL database, followed by the construction of a robust data model and the development of over 30 DAX measures in Power BI.

Key findings reveal a portfolio with strong overall performance but significant underlying risk. While the "Good Loan" segment is highly profitable (generating over \$65.5 million in profit), the "Bad Loan" segment, representing 13.8% of the portfolio, has resulted in a net loss of over \$28.2 million. Further analysis identified "Debt Consolidation" as the primary driver for loan applications and borrowers with 10+ years of employment as the most valuable customer segment.

This report concludes with three data-driven recommendations focused on refining risk assessment, focusing marketing efforts, and targeting high-value customer segments to mitigate losses and enhance overall profitability.

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1. Project Objectives

The project was initiated with four specific goals to address the challenge of extracting meaningful insights from the complex loan dataset:

- **Calculate and Monitor KPIs:** To track portfolio performance, including MTD and MoM growth for loan applications, funded amounts, received amounts, interest rates, and DTI.
- **Analyze and Segment the Loan Portfolio:** Categorize loans into 'Good Loan' and 'Bad Loan' segments for risk analysis and exposure tracking.
- **Design and Build an Interactive Dashboard:** Create a dynamic 3-page Power BI report (Summary, Overview, Details).
- **Extract Actionable Insights:** Provide clear, data-driven recommendations to improve strategies, mitigate risk, and boost profitability.

2. Methodology & Technical Approach

2.1 Data Sourcing & Preparation (MySQL)

- Raw financial_loan.csv (38,577 records) loaded into MySQL using LOAD DATA LOCAL INFILE.
- On-the-fly transformations with STR_TO_DATE() handled date inconsistencies.
- 25+ SQL validation queries created a **Query Doc** for verifying Power BI calculations.

2.2 Data Modeling (Power BI)

- Connected Power BI to MySQL.
- Designed a **Star Schema** with a dedicated Date Table (CALENDARAUTO()), marked as the official date table.

- One-to-Many relationship established between Date Table and Loan Fact Table.

2.3 Analysis & Calculation (DAX)

- Created a dedicated _Key Measures table with 30+ DAX measures.
- **Base Measures:** COUNT, SUM for core metrics.
- **Time Intelligence:** MTD, PMTD, and MoM growth using DIVIDE().
- **Segmentation:** CALCULATE() applied for Good Loan/Bad Loan KPIs.

2.4 Visualization & Reporting (Power BI)

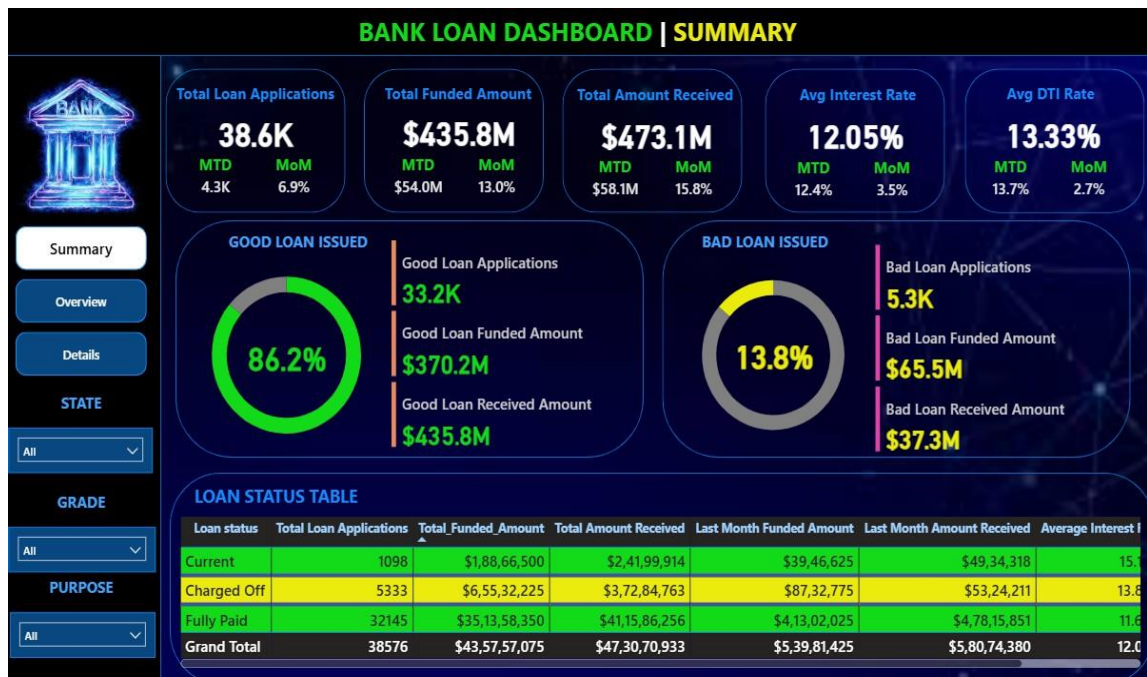
- Built **3-page interactive report** (Summary, Overview, Details).
- Implemented **Field Parameters** for dynamic metric switching.
- Enabled cross-filtering with "Edit Interactions".
- Added page navigation buttons for seamless UX.

3. Key Findings & Analysis

3.1 Portfolio Health Overview

The Summary Dashboard provides a high-level view of the portfolio's health. Overall, the metrics are strong, with all KPIs showing positive Month-over-Month growth. However, the most significant top-level finding is the portfolio's risk composition:

- **Good Loans (Fully Paid & Current):** Comprise **86.2%** of all loan applications.
- **Bad Loans (Charged Off):** Comprise **13.8%** of all loan applications.



3.2 The Financial Impact of Risk: Profit & Loss Analysis

While the 13.8% default rate is a key risk indicator, its true impact is revealed by analyzing the cash flow from the Good vs. Bad loan segments:

- The **Good Loan** segment has been highly profitable, generating a net profit of **+\$65.5 million** (\$435.7M Received - \$370.2M Funded).
- Conversely, the **Bad Loan** segment has resulted in a significant financial loss. Of the \$65.5M funded to these borrowers, only \$37.2M was recovered, resulting in a net loss of **-\$28.2 million**.

This analysis reveals that the losses from the defaulted 13.8% of the portfolio have effectively nullified over 40% of the profits generated by the healthy 86.2%.

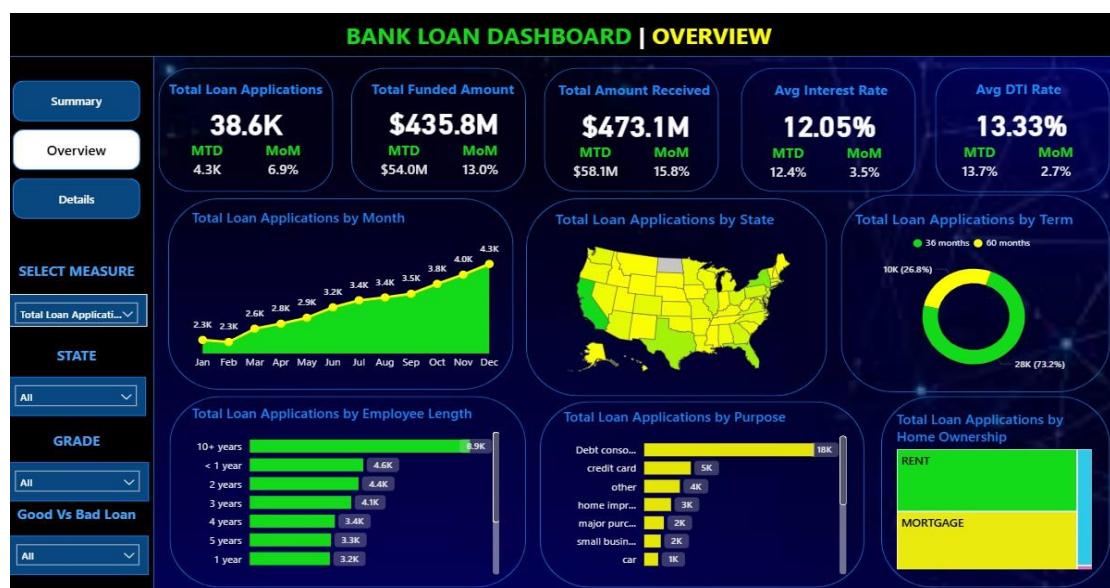
3.3 Key Customer Segmentation Insights

The Overview Dashboard provides a multi-dimensional view of the customer base, revealing key trends and segment characteristics:

- **(Monthly Trend):** The line chart shows a consistent and strong **upward trend in loan applications throughout the year**, culminating in a peak in December. This indicates growing business momentum and potential seasonality.
- **(Geographic Concentration):** The analysis confirmed that **California** is the bank's

largest and most critical market by a significant margin, leading in both application volume and total funded amount.

- **(Loan Term Preference):** The donut chart reveals a clear customer preference for shorter-term loans, with **'36-month' terms accounting for over 73%** of all loan applications.
- **(Borrower Stability):** The bar chart for employee length shows that borrowers with **'10+ years' of employment history** are the single largest segment, representing the most stable and valuable customer profile for the bank.
- **(Primary Loan Purpose):** The overwhelming driver for loan applications is **"Debt Consolidation,"** with over 18,000 applications. This indicates the bank's primary service is helping customers manage existing debt, rather than financing new purchases.
- **(Home Ownership Profile):** The treemap shows that the two largest customer segments by volume are those who **'RENT'** and those who have a **'MORTGAGE'**. While renters apply slightly more often, mortgage holders account for a larger total funded amount, suggesting they qualify for larger loans.



3.4 Granular Data Exploration (Details Dashboard)

The Details dashboard provides a row-level view of the entire loan dataset, serving as a vital tool for deep-dive analysis. This page allows analysts and managers to filter the portfolio based on any combination of criteria (e.g., State, Grade, Loan Status) and view the specific loan records that match. This feature is essential for investigating anomalies, understanding specific customer cohorts, and providing detailed data extracts for further ad-hoc analysis.



4. Actionable Recommendations

Based on the key findings, the following three data-driven recommendations are proposed to mitigate risk and enhance business strategy:

1. Refine Risk Assessment & Underwriting Criteria:

- **Recommendation:** Prioritize a deep-dive analysis on the 5,333 'Charged Off' loans using the Details dashboard.
- **Action:** Identify common characteristics and leading indicators of defaulting borrowers (e.g., specific grades, DTI ranges, loan purposes). Use these findings to build a more predictive risk model and tighten the loan approval criteria for new applicants who fit this high-risk profile.

2. Focus Marketing Efforts on Core Customer Needs:

- **Recommendation:** Align marketing strategy with the proven primary customer motivation.
- **Action:** Double down on marketing campaigns, keywords, and product messaging that highlight the benefits of "Debt Consolidation." This will more effectively attract and convert the bank's largest customer segment.

3. Develop Targeted Strategies for High-Value Segments:

- **Recommendation:** Nurture and expand business with the most stable and profitable customer segments.
- **Action:** Develop a targeted marketing campaign or a premium loan product

specifically for customers with '10+ years' of employment and existing mortgages, particularly within the top market of California.

5. Conclusion

This project successfully achieved its objective of transforming a large, raw dataset into a clear, reliable, and interactive analytical tool. The Power BI dashboard provides a comprehensive view of the bank's loan portfolio, enabling stakeholders to monitor performance, explore trends, and identify risks in real-time.

The analysis has quantified the significant financial impact of loan defaults (a **\$28.2M net loss**) and has provided clear, actionable recommendations to improve risk modeling and focus marketing strategies. This project serves as a strong foundation for data-driven decision-making to enhance the bank's overall profitability.

6. Appendix

- The complete, interactive Power BI report (.pbix file) is available on the project's GitHub repository.
- The Query Doc.docx containing all SQL validation queries and their outputs is also available in the repository.