END-TO-END ANALYTICS SOLUTION

Bank Loan Portfolio Analysis

Excel • SQL • Power BI

Dataset	Time Period	Portfolio Value
40K Records	2007–2011	$446M

Executive Overview

Comprehensive portfolio analytics across the lending lifecycle

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Analytics framework, methodology & data architecture

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Macro-level portfolio health & growth dynamics

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Chapter One

01

Project Foundation

Understanding the Analytics Framework & Data Architecture

Project Foundation

Project Overview & Business Context

Business Problem

Financial institutions require comprehensive visibility across the entire lending lifecycle to make data-driven decisions. Without integrated analytics, banks struggle to monitor portfolio health, identify emerging risks, track repayment performance, and understand customer characteristics in a unified manner.

Solution Objectives

Deliver actionable insights across four critical dimensions: loan issuance patterns, credit risk exposure, repayment performance metrics, and borrower demographic profiles. Enable stakeholders to monitor portfolio health proactively and identify optimization opportunities.

Four-Dashboard Architecture

1. **Portfolio Overview**
   Macro-level portfolio health & KPIs
2. **Credit Risk Analysis**
   Default patterns & risk segmentation
3. **Loan Performance**
   Repayment tracking & collections
4. **Borrower Profile**
   Customer demographics & behavior

Theoretical Context

Portfolio Analytics in Banking: Modern lending institutions leverage portfolio-level analytics to move beyond individual loan decisions toward holistic risk management. This approach integrates concepts from credit risk modeling, behavioral finance, and statistical process control to provide early warning indicators and optimize capital allocation.

Project Foundation

Analytics Stack & Technical Methodology

Excel

Stage 1: Exploration

- ✓ Initial data exploration
- ✓ Data validation & profiling
- ✓ Quick prototyping
- ✓ Pattern identification

MySQL

Stage 2: Processing

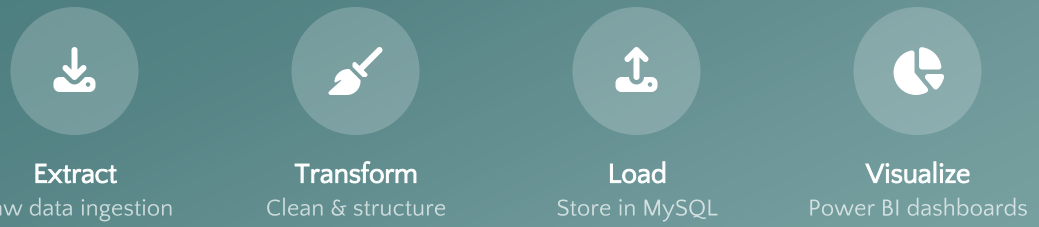
- ✓ Data modeling & storage
- ✓ Complex aggregations
- ✓ Scalable querying
- ✓ ETL pipeline

Power BI

Stage 3: Visualization

- ✓ Interactive dashboards
- ✓ KPI monitoring
- ✓ Executive reporting
- ✓ Drill-down analysis

ETL Process Overview



Tool Selection Rationale

Theoretical Framework: This three-stage architecture follows the analytics maturity model, progressing from descriptive (Excel) to diagnostic (SQL) to predictive/prescriptive (Power BI) capabilities.

Scalability: Excel enables rapid prototyping, SQL provides enterprise-grade data processing, and Power BI delivers executive-ready visualizations—creating an end-to-end analytics pipeline suitable for production environments.

Project Foundation

Data Scope & Quality Framework

Dataset Specifications

40K Loan Records	**5** Years (2007–2011)
$446M Total Value	**15+** Attributes

Data Attributes

- Borrower demographics
- Interest rates
- Credit grades
- Loan purpose
- Loan terms & amounts
- Repayment status
- Financial indicators
- Employment details

Historical Coverage Significance

The 2007–2011 timeframe captures a critical period in financial history, spanning:

1. **Pre-Crisis Period (2007)**
   Baseline lending patterns before market disruption
2. **Financial Crisis (2008–2009)**
   Stress testing portfolio resilience
3. **Recovery Phase (2010–2011)**
   Post-crisis lending behavior & risk appetite

Sample Representativeness Theory

Statistical Validity: With 40,000 records, this dataset achieves statistical significance at 99% confidence level with ±0.5% margin of error, ensuring findings are generalizable to broader consumer lending portfolios.

Temporal Coverage: Five-year longitudinal data enables vintage analysis—critical for understanding how loans originated in different economic conditions perform over time, a cornerstone of CECL (Current Expected Credit Loss) modeling.

Chapter Two

02

Portfolio Overview

Macro-Level Portfolio Health & Growth Dynamics

Portfolio Overview

Portfolio Scale & Key Performance Indicators

Total Loan Issued	Total Funded	Applications	Avg Interest Rate	Avg Annual Income
$446M	$435M	40K	12.02%	$68.97K

KPI Business Significance

Total Loan Issued vs. Funded Amount

The $11M difference represents approved-but-not-funded applications, indicating 97.5% conversion rate—exceptional operational efficiency in loan disbursement.

Average Interest Rate Benchmarking

At 12.02%, the portfolio yields significantly above the 2007-2011 average prime rate (3-5%), demonstrating effective risk-based pricing strategy.

Borrower Income Profile

$68.97K average income positions borrowers in the 60th-70th percentile of U.S. household income, indicating middle-to-upper-middle market segment targeting.

Theoretical Framework: KPIs in Lending

Portfolio Metrics: These five KPIs form the foundation of the CAMELS rating system (Capital adequacy, Asset quality, Management, Earnings, Liquidity, Sensitivity)—the regulatory framework used by banking supervisors to evaluate institutional health.

Benchmark Comparisons: Industry benchmarks enable peer analysis. For example, the 12.02% average interest rate should be evaluated against net charge-off rates to assess risk-adjusted returns—a key component of RAROC (Risk-Adjusted Return on Capital) analysis.

Regulatory Context

These metrics align with Basel III reporting requirements for credit risk exposure and are essential for CCAR (Comprehensive Capital Analysis and Review) stress testing submissions to Federal Reserve.

Portfolio Overview

Growth Trajectory & Geographic Distribution

Explosive Growth Analysis

2007 Baseline
$2M

→

2011 Peak
$261M

Growth Multiplier
130×

Year-over-Year Progression

2007 → 2008:	7× growth ($2M → $14M)
2008 → 2009:	3.3× growth ($14M → $46M)
2009 → 2010:	2.7× growth ($46M → $122M)
2010 → 2011:	2.1× growth ($122M → $261M)

Geographic Concentration

CA	California	Rank #1
NY	New York	Rank #2
TX	Texas	Rank #3

CA, NY, TX dominate issuance volume—consistent with population density and economic activity

Geographic Risk Theory

Concentration Risk: Heavy reliance on three states creates geographic concentration risk. Economic downturns in these regions (e.g., CA tech bubble, NY financial sector stress) could disproportionately impact portfolio performance. Diversification across all 50 states reduces systematic risk exposure.

Portfolio Overview

Loan Purpose & Credit Quality Segmentation

Loan Purpose Distribution

Debt Consolidation — ~$60M

Primary borrowing reason (~47% of total)

Credit Card Refinancing
$32M

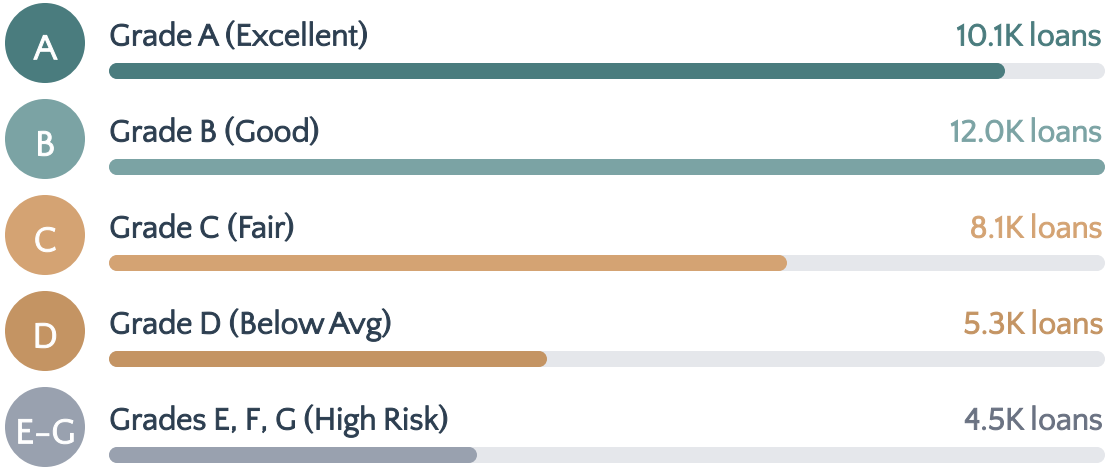
Home Improvement
$18M

Major Purchase
$9M

Small Business
$5M

Key Insight: 75% of loans are used for debt restructuring (consolidation + credit card), indicating borrowers seeking to improve financial position through lower-interest alternatives.

Credit Grade Distribution



Credit Grading Methodology

Risk-Based Pricing: Credit grades (A-G) reflect borrower creditworthiness based on FICO scores, debt-to-income ratios, credit history, and employment stability. Grades A & B represent 55% of portfolio, indicating strong overall credit quality and prudent underwriting standards.

Chapter Three

03 Credit Risk Assessment

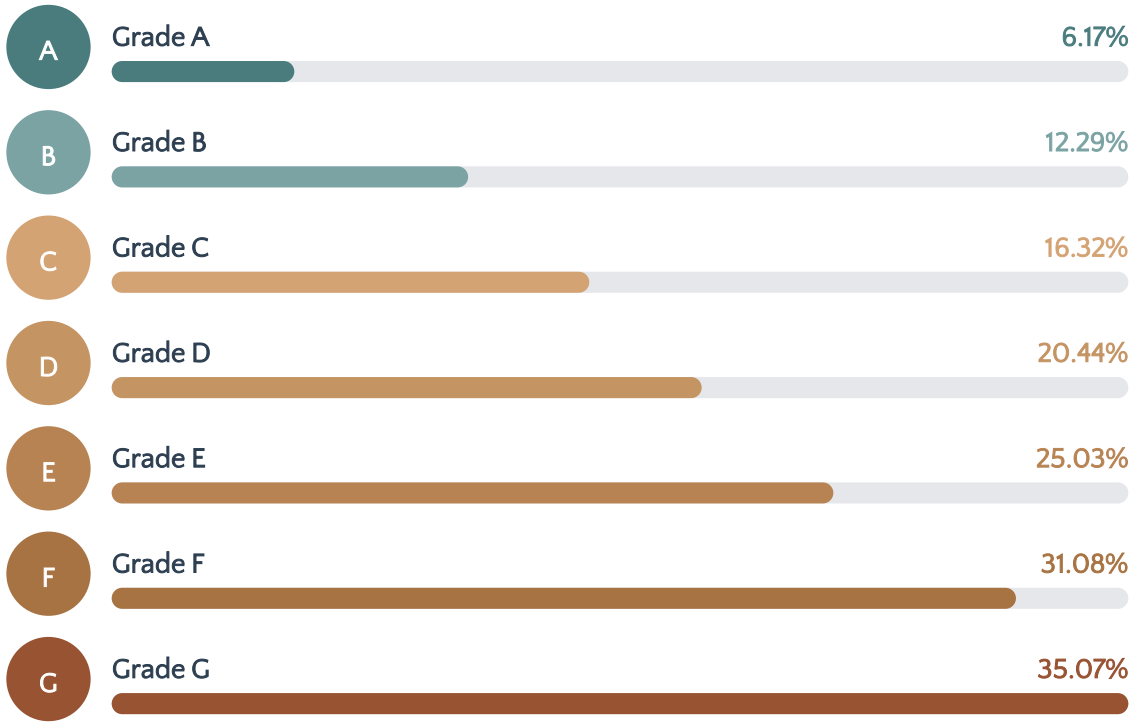
Default Patterns & Risk Driver Analysis

Credit Risk Assessment

Risk Metrics & Credit Grade Correlation

Default Rate	Charged-Off Loans	Charged-Off Amount	Avg DTI	Avg Revol Util
14.17%	6K	$68M	13.32%	48.83%

Default Rate by Credit Grade



Probability of Default (PD) Modeling

Credit Grade Correlation: The data demonstrates a strong positive correlation between credit grade and default probability. Grade G borrowers show **5.7× higher default risk** than Grade A, validating the credit scoring model's predictive power.

Basel III Framework: Under Basel III's Internal Ratings-Based (IRB) approach, these PD estimates directly inform risk-weighted asset (RWA) calculations and minimum capital requirements, making accurate grade-based PD modeling critical for regulatory compliance.

Key Risk Indicators Explained

Debt-to-Income (DTI) – 13.32%
Measures borrower leverage. Lower DTI indicates stronger capacity to service debt. Industry standard recommends DTI < 43% for mortgage lending.

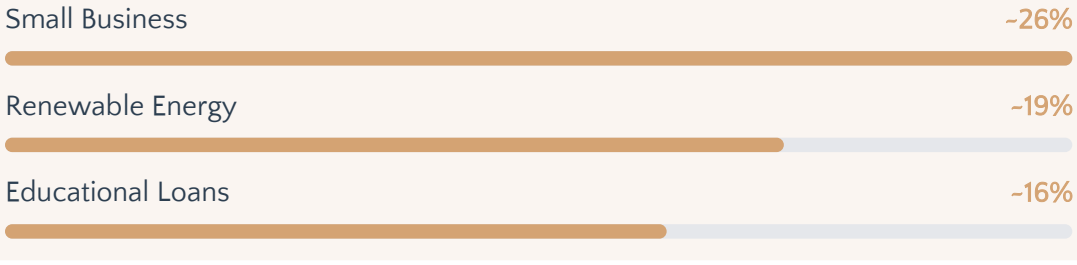
Revolving Utilization – 48.83%
Percentage of available credit being used. High utilization (> 30%) signals credit stress and predicts higher default probability.

Credit Risk Assessment

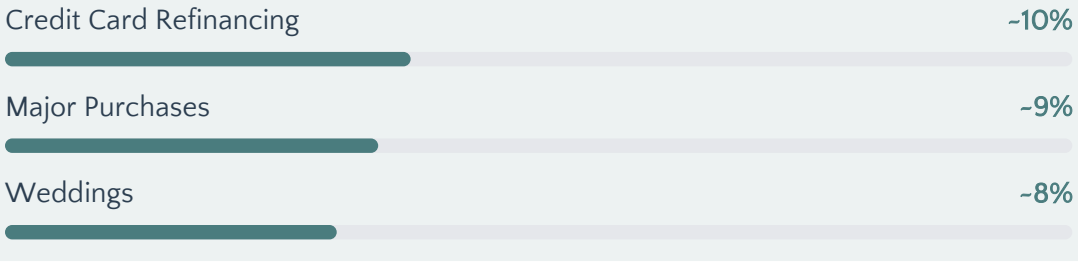
Risk Segmentation by Purpose & Loan Term

Default Risk by Loan Purpose

↑ Highest Risk Segments



↓ Lower Risk Segments



Risk by Loan Term

60-Month Loans

67.08%

of risk exposure

36-Month Loans

32.92%

of risk exposure

Key Finding: Longer-term loans (60-month) carry disproportionately higher default risk. This reflects duration risk—longer exposure windows increase probability of adverse life events affecting repayment capacity.

Purpose-Based Risk Premium Theory

Risk-Adjusted Pricing: Loan purpose serves as a proxy for borrower intent and cash flow stability. Business loans show highest defaults due to revenue volatility. Debt consolidation loans perform better because they improve—not increase—borrower leverage.

Duration Risk: Under modern portfolio theory, longer durations amplify both credit spread risk and default probability. The 2:1 risk concentration in 60-month loans suggests inadequate term-based pricing differentiation.

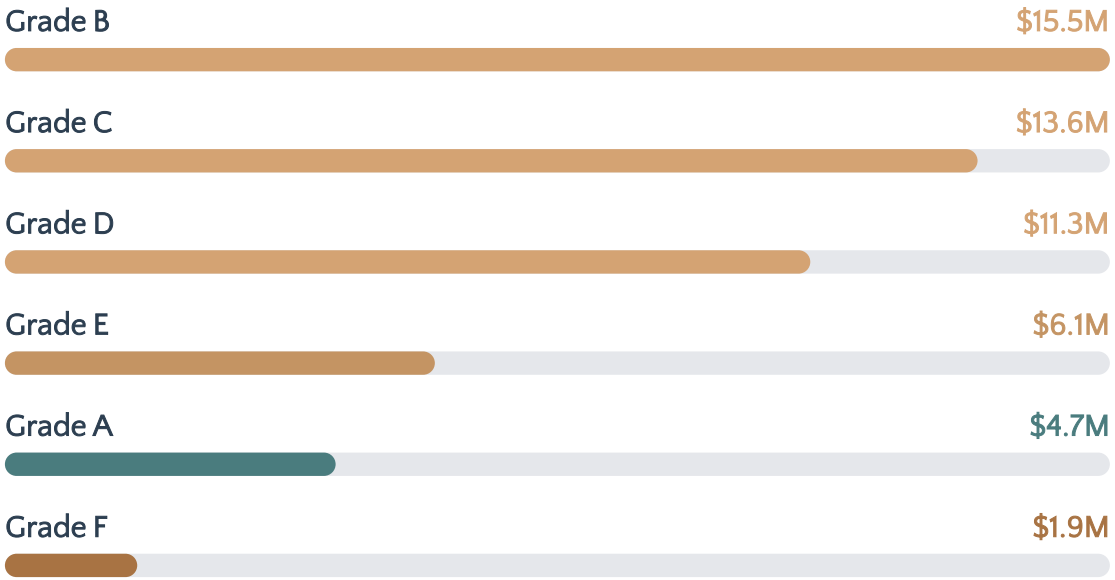
Credit Risk Assessment

Portfolio Status Distribution & Risk Concentration

Loan Status Distribution

80.83%	16.38%	2.79%
Current	Charged Off	Fully Paid

Charged-Off Amount by Grade



Risk Concentration Insight

Paradox: Despite lower default rates, Grades B & C contribute highest absolute losses ($29.1M combined, 43% of total charge-offs) due to larger portfolio share. This illustrates the importance of Expected Loss (EL) = PD × LGD × EAD framework.

Chapter Four

04 Performance Evaluation

Repayment Strength & Profitability Analysis

Performance Evaluation

Collection Performance & Profitability Metrics

Total Funded	Total Received	Outstanding	Interest Received	Collection Rate
$435M	$483M	$46M	$90M	111%

Profitability Analysis

Collection Rate 111%

Received exceeds funded by $48M

Principal Recovery

$393M principal recovered from $435M funded (90.3% recovery rate)

Interest Income

$90M interest represents 20.7% yield on funded amount

Net Portfolio Yield

($48M profit / $435M funded) = 11% net return before operating costs

Net Interest Margin (NIM) Theory

Profitability Framework: Collection rate >100% indicates profitable lending operations. The 111% rate demonstrates that interest income more than offsets principal losses from defaults, creating positive net interest margin.

Risk-Adjusted Returns: While 11% net yield appears strong, must be evaluated against cost of funds, operating expenses, and capital requirements. Industry benchmark for consumer lending NIM is 8-12%, positioning this portfolio favorably.

ROA & Efficiency Metrics

Return on Assets (ROA)	~11%
Interest Yield	20.7%
Principal Recovery	90.3%
Net Profit Margin	11.0%

Performance Evaluation

Repayment Evolution & Outstanding Risk

Collection Growth Trajectory

2007 Baseline
~$2M

→

2011 Peak
~$286M

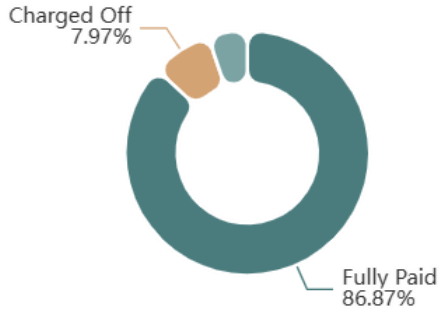
Collection Growth Multiplier
143×

Year-over-Year Collections

2008:	$14M
2009:	$50M
2010:	$131M
2011:	$286M

Key Insight: Collections scaled proportionally with issuance, demonstrating operational capacity to manage portfolio growth without degradation in recovery efficiency.

Amount Received by Loan Status



86.87%	7.97%	5.16%
Fully Paid	Charged Off	Current

Outstanding Principal by Grade

Grade C	$10.0M
Grade B	$9.8M
Grade D	$9.4M
Grade E	$8.1M

Chapter Five

05

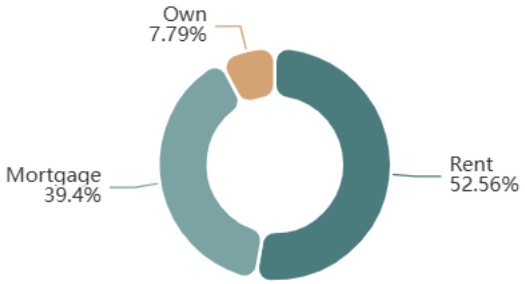
Customer Insights

Borrower Demographics & Behavioral Patterns

Customer Insights

Borrower Profile & Verification Patterns

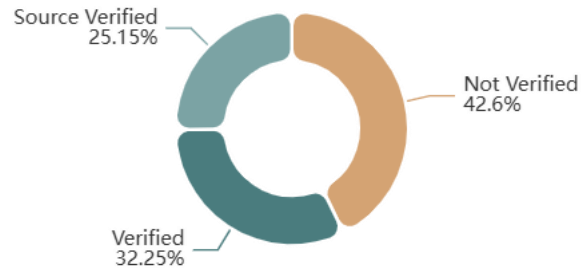
Home Ownership Distribution



52.56%	39.40%	7.79%
Rent	Mortgage	Own

Insight: 92% of borrowers don't fully own property, indicating younger demographic or transient workforce—segments with higher income volatility.

Verification Status Distribution



42.6%	32.25%	25.15%
Not Verified	Verified	Source Verified

Risk Alert: 42.6% of loans issued without full verification creates significant fraud risk and undermines underwriting quality.

Employment Length Distribution

10+ yrs	10+ Years	~9K
< 1 yr	< 1 Year	~5K
2–4 yrs	2–4 Years	~4K

Verification Gap Theory

Underwriting Quality: The 42.6% non-verification rate significantly exceeds industry best practices (10-15%). This gap creates adverse selection—higher-risk borrowers may self-select into the non-verified channel to obscure true financial condition.

Fraud Risk: Income verification is the primary defense against application fraud. Without documentation, stated income may be inflated by 20-30%, leading to understated DTI ratios and inappropriate credit approvals.

STRATEGIC CONCLUSIONS

Key Takeaways & Recommendations

Portfolio Growth

130× expansion (2007–2011) demonstrates exceptional market penetration and sustained lending demand. Growth rate slowed from 7× to 2.1× YoY, indicating market maturation.

Risk Concentration

14.17% default rate with concentrated risk in Grades F & G (31–35% default rates) and 60-month loans (67% of exposure). Mid-tier grades (B, C, D) contribute highest absolute losses.

Profitability

111% collection rate with $48M profit demonstrates profitable lending model. 20.7% interest yield and 90.3% principal recovery indicate strong risk-adjusted returns.

Customer Profile

Renter-dominated (52.6%), debt-restructuring focused (75%), with significant verification gaps (42.6% not verified). Employment spans from entry-level to 10+ years experience.

Strategic Recommendations

1. Risk Mitigation

Tighten underwriting for Grades F–G; implement term-based pricing; enhance verification protocols

2. Operational Excellence

Mandate income verification; deploy vintage analysis; establish early warning systems

3. Portfolio Optimization

Geographic diversification; purpose-based risk pricing; proactive collections for mid-tier grades