Project Title: Loan Officer Risk Monitor (Scenario-Based Borrower Risk Assessment)

Project Overview:

This project aims to support loan officers in assessing borrower risk by simulating different loan scenarios. Using core financial ratios—Debt Service Coverage Ratio (DSCR), Debt-to-Income (DTI), and Loan-to-Value (LTV)—each borrower's likelihood of default is categorized and visualized interactively.

Rather than using machine learning or complex predictive algorithms, this dashboard emphasizes business-driven, interpretable metrics. It allows users to assess the impact of key financial changes (like income, debt, or loan amount) on loan approval risk.

Business Problem Statement:

"How can loan officers proactively assess borrower risk and flag potential defaults before loan approval?"

The project provides a monitoring tool that highlights:

- Scenarios with low repayment capacity
- Applicants with high debt exposure
- Borrowers with over-leveraged collateral

Tools and Techniques Used

- SQL (optional) – for initial exploration (if using large datasets)
- Excel – for scenario modeling and financial metric calculations (DSCR, DTI, LTV)
- Power BI – for interactive dashboard design and risk visualization

Methodology and Approach

1. **Data Cleaning & Scenario Modeling (Excel)**

Manually simulate loan application scenarios and compute core financial risk indicators for each case.

Cleaning Steps:

Task	Description
Removed blanks and nulls	Missing income, appraised_value, and loan_amount filled with realistic assumptions
Verified data types	Ensured all financial values are numeric
Removed text errors	Corrected format issues for percentages and currency
Standardized inputs	Rounded values, consistent formatting for modeling

Scenarios Designed:

Scenario	Income	Loan Amount	Debt	Term	DSCR	DTI	LTV	Risk
Scenario 1	2500	12,000	1,800	36	1.119	0.72	1.2	Low
Scenario 2	4000	18,000	800	48	3.18	0.20	0.60	High
Scenario 3	2500	10,000	2327	36	0.92	0.93	0.833	Low

Scenario 2 was flagged as High Risk, with all three metrics outside of recommended thresholds.

Calculated Metric Explained:

Metric	Description	Formula	Ideal Range
DSCR	Borrower's ability to repay debt	Income / (Monthly Debt + Payment)	> 1.5
DTI	Debt burden relative to income	Monthly Debt / Income	< 0.4
LTV	Loan amount vs. property value	Loan Amount / Appraised Value	< 0.8
MonthlyPay	Amount paid monthly by borrower	=PMT(rate/12, term, -loan_amount)	

Borrowers with DSCR < 1, DTI > 0.5, or LTV > 0.85 are flagged as higher risk.

Risk Categorization Rule:

- DSCR < 1.0 → High Risk ⬤
- DTI > 0.5 → Medium/High Risk ☐
- LTV > 0.85 → Flag for review ▲

2. Data Exploration (SQL)

Explored some of the default tendencies of borrowers

■ **Check Loan Status Distribution**

```sql
SELECT `Loan Status`, COUNT(*) AS total

FROM loan_risk_sample

GROUP BY `Loan Status`;
```

■ **Average Loan Amount by Employment Duration**

```sql
SELECT Employement_Duration,

    COUNT(*) AS total_loans,

    AVG(Loan_Amount) AS avg_loan_amount

FROM loan_risk_sample

GROUP BY Employement_Duration

ORDER BY avg_loan_amount DESC;
```

■ **Debt to Income Comparison**

```sql
SELECT

    CASE WHEN Debit_ToIncome < 10 THEN 'Low DTI'

        WHEN Debit_ToIncome BETWEEN 10 AND 20 THEN 'Medium DTI'

        ELSE 'High DTI'

    END AS DTI_Category,

    COUNT(*) AS total,

    AVG(Loan_Amount) AS avg_loan,

    ROUND(100.0 * SUM(CASE WHEN `Loan Status` = 1 THEN 1 ELSE 0 END) / COUNT(*), 2) AS
default_rate_pct

FROM loan_risk_sample

GROUP BY DTI_Category;
```
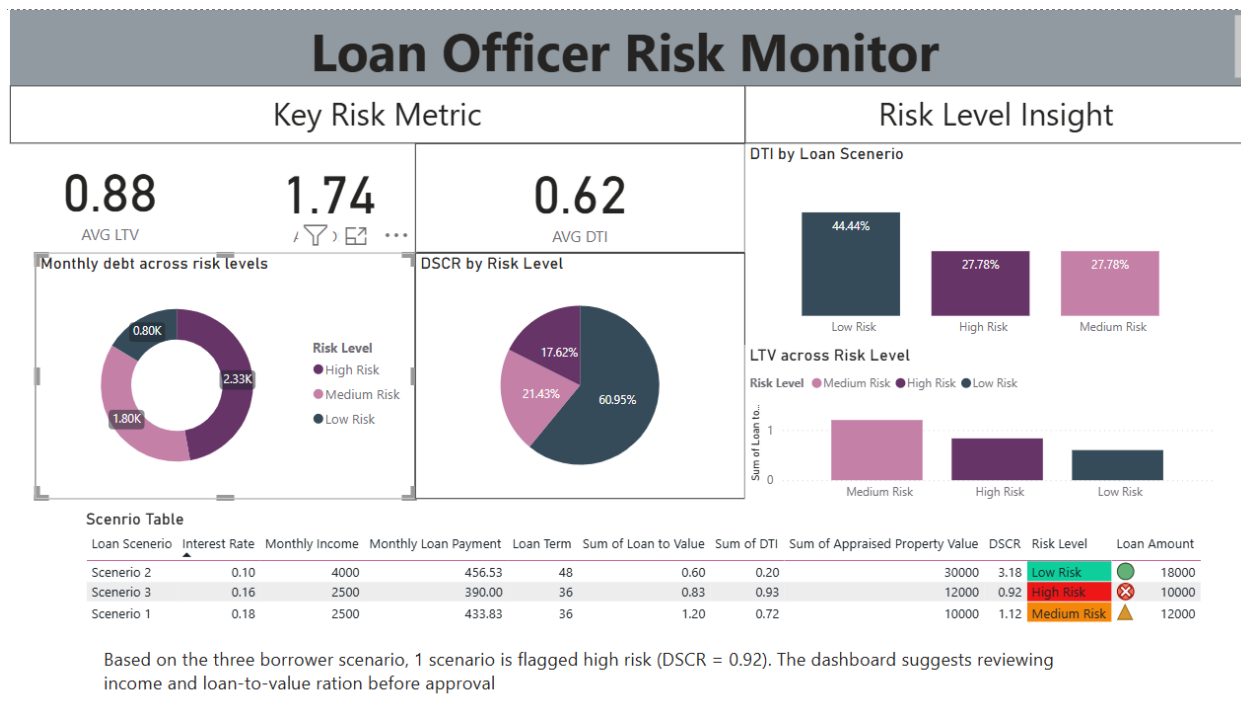
■ **Default Rate by Employement Type**

```sql
SELECT Employement_Duration,

    COUNT(*) AS total_applicants,

    SUM(CASE WHEN `Loan Status` = 1 THEN 1 ELSE 0 END) AS defaulted,

    ROUND(100.0 * SUM(CASE WHEN `Loan Status` = 1 THEN 1 ELSE 0 END) / COUNT(*), 2)
AS default_rate_pct

FROM loan_risk_sample

GROUP BY Employement_Duration

ORDER BY default_rate_pct DESC;
```

3. Dashboard Design & Visualization (Power BI)

Create an interactive dashboard to help loan officers assess borrower risk based on scenario simulations.

Data Import:

- Excel model imported into Power BI via Get Data → Excel

- Structured as one row per scenario

- Clean headers and no merged cells

Loan Officer Risk Monitor

Key Risk Metric / Risk Level Insight

Loan Scenerio	Interest Rate	Monthly Income	Monthly Loan Payment	Loan Term	Sum of Loan to Value	Sum of DTI	Sum of Appraised Property Value	DSCR	Risk Level		Loan Amount
Scenario 2	0.10	4000	456.53	48	0.60	0.20	30000	3.18	Low Risk	●	18000
Scenario 3	0.16	2500	390.00	36	0.83	0.93	12000	0.92	High Risk	⊗	10000
Scenario 1	0.18	2500	433.83	36	1.20	0.72	10000	1.12	Medium Risk	⚠	12000

Based on the three borrower scenario, 1 scenario is flagged high risk (DSCR = 0.92). The dashboard suggests reviewing income and loan-to-value ration before approval

Insights and Recommendations:

- 1 out of 3 scenarios is flagged as High Risk

Recommend tightening approval filters for applicants with DSCR below 1.

- High LTV scenarios (>0.9) should trigger secondary appraisal or request for additional equity.

- DTI above 0.5 may indicate the borrower is overleveraged — consider income verification or cosigner.

- Provide "Red Flag Reports" for underwriters with key financial triggers.

Why This Project Stands Out:

- Focused on real-world business metrics (vs. pure ML)

- Provides interactive risk analysis from multiple borrower perspectives

- Helps non-technical loan officers interpret financial risks

- Includes a scenario-based model built in Excel and integrated into Power BI

LINKS : https://github.com/Deejarh-ops/Deejerh.github.io/blob/main/Loan%20Risk%20Exploration.sql