POWERBI CAPSTONE PROJECT - BANK LOAN PERFORMANCE ANALYSIS

IDENTIFY DATA INSIGHTS

ARUNPRASATH S

INDEX:

CHAPTER - I

INTRODUCTION:

The transfer of funds from one party to another with the commitment to repay it is known as a loan in the finance industry. In exchange for using the money, the borrower, also known as the recipient, incurs debt and typically has to pay interest.

Typically, the promissory note or equivalent paperwork proving the debt will include the principle amount borrowed, the interest rate the lender is charging, and the repayment date. A loan means that the borrower and the lender will temporarily reallocate the subject asset or assets.

The interest gives the lender a reason to proceed with the loan. Each of these duties and limitations in a legal loan is enforceable through contract, which also has the power to impose additional limitations on the borrower known as loan covenants. While the focus of this essay is on financial loans, practically any material object could be lent.

One of the primary functions of financial organizations like banks and credit card firms is to make loans. Bonds and other debt contracts are common sources of finance for other institutions.

Types:

Protected:

A secured loan is a type of debt where the borrower offers up an asset as security, such as a house or automobile.

Many people utilize a mortgage loan, which is a very popular kind of financing, to buy residential or commercial real estate. Until the mortgage is fully repaid, the lender, which is typically a financial institution, is granted security in the form of a lien on the property title. In the event that a borrower fails on a home loan, the bank is legally entitled to take possession of the property and sell it to recoup any outstanding debt.

In the same way, an auto loan may be backed by the vehicle itself. The loan term is somewhat shorter, frequently matching the vehicle's usable life. Auto loans come in two varieties: direct and indirect. A bank loans money to a customer directly when they get a direct vehicle loan. A car dealership (or a related business) serves as a middleman between the customer and the bank or other financial institution in an indirect auto loan.

Loans secured by securities, such as bonds, mutual funds, shares, etc., are examples of additional secured loan types. Customers can obtain a line of credit through this specific instrument, which is granted based on the quality of pledged securities. Customers who have pledged things are evaluated for the quantity and purity of gold before being granted gold loans. Corporate entities may also obtain secured loans by guaranteeing the company's assets, which may include the business itself. Generally speaking, secured loans have cheaper interest rates than unsecured loans. Before authorizing the loan, the lending institution typically hires individuals (on a contract or roll-call basis) to assess the quality of the pledged collateral.

Unsecured:

Financial loans that are not backed by the borrower's assets are known as unsecured loans. Financial institutions may provide them in a variety of forms or marketing bundles:

- Credit histories
- Individual loans
- Overdrafts at banks
- Credit lines or facilities
- Corporate debts, which could be secured or not
- Mutual-to-peer financing

Depending on the lender and the borrower, different interest rates may apply to these various forms. There might be legal regulations on these or not. In the UK, the Consumer Credit Act of 1974 may apply to them where they relate to persons.

Because an unsecured lender has significantly fewer possibilities for taking legal action against the borrower in the case of default, interest rates on unsecured loans are almost always higher than those on secured loans. This is because an unsecured lender is taking on greater risk than they would be with a secured loan. In order to enforce the judgment against the borrower's unencumbered assets—those not previously pledged to secured lenders—an unsecured lender must file a lawsuit against the borrower, win a monetary judgment for breach of contract, and then pursue judgment execution. When a court divides up the borrower's assets during insolvency proceedings, secured lenders typically have precedence over unsecured lenders. Therefore, a higher interest rate represents the added risk that the debt might not be recouped in the event of insolvency.

Demand:

Demand loans are short-term loans that typically do not have fixed dates for repayment. Instead, demand loans carry a floating interest rate, which varies according to the prime lending rate or other defined contract terms. Demand loans can be "called" for repayment by the lending institution at any time. Demand loans may be unsecured or secured.

Subsidized:

A subsidized loan is a loan on which the interest is reduced by an explicit or hidden subsidy. In the context of college loans in the United States, it refers to a loan on which no interest is accrued while a student remains enrolled in education.

Concessional:

A concessional loan, sometimes called a "soft loan", is granted on terms substantially more generous than market loans either through below-market interest rates, by grace periods, or a combination of both. Such loans may be made by foreign governments to developing countries or may be offered to employees of lending institutions as an employee benefit (sometimes called a perk).

Target markets

Personal:

Finances, auto loans, credit cards, home equity lines of credit, installment loans, and payday loans are examples of common personal loans. An important factor in the underwriting and interest rates (APR) of these loans is the borrower's credit score. If you choose a longer payment term for your personal loan, you can lower the monthly payments, but you will also pay more interest altogether. Banks, alternative (non-bank) lenders, online lenders, and private lenders are all possible sources for a personal loan.

Commercial:

Loans to businesses are similar to the above but also include commercial mortgages and corporate bonds and government guaranteed loans Underwriting is not based upon credit score but rather credit rating.

Loan payment

The most typical loan payment type is the fully amortizing payment in which each monthly rate has the same value over time.

The fixed monthly payment P for a loan of L for n months and a monthly interest rate c is:

$$P = L \cdot \frac{c(1+c)^n}{(1+c)^n - 1}$$

CHAPTER - II

AREA OF STUDY:

Problem Statement:

In today's data-driven world, understanding how borrower details and loan characteristics impact loan performance is very important for banking institutions. This project seeks to delve deep into a lending loan dataset to uncover the relationship between borrower behavior (such as employment length, income, and debt-to-income ratio) and loan characteristics (including amount, term, and interest rate) to unearth critical insights into loan performance metrics. By examining patterns in loan statuses such as fully paid, charged off, or late payments, this analysis aims to empower banking institutions with actionable insights to optimize loan lending strategies, mitigate credit risk, and enhance overall portfolio performance.

Dataset Download: https://drive.google.com/uc?export=download&id=1yNL9gfv-DlD3cEW9o2GJvtJ9Bzbm37R7

The dataset "bank loan.xlsx" contains two sheets: 1. LoanDetails: This sheet contains information about each loan. 2. BorrowerDetails: This sheet provides details about the borrowers.

Variable Declaration:

Table Name	Field Name	Description
LoanDetails	id	Unique identifier for each loan.
	loan_amnt	The amount of money requested by the borrower.
	funded_amnt	The actual amount of money funded for the loan.
	term	The duration of the loan in months.
	int_rate	The interest rate of the loan.
	installment	The monthly payment owed by the borrower.
	grade	The loan grade assigned by the lending company.
	sub_grade	The loan subgrade assigned by the lending company.
	issue_d	The month in which the loan was funded.
	purpose	The reason provided by the borrower for the loan.

Table Name	Field Name	Description
BorrowerDetails	id	Unique identifier for each loan.
	member_id	Unique identifier for each borrower.
	emp_length	Employment length in years.
	home_ownership	The status of home ownership reported by the borrower.
	annual_inc	The annual income reported by the borrower.
	verification_status	Indicates if the borrower's income was verified.
	dti	The debt-to-income ratio of the borrower.
	delinq_2yrs	The number of past-due incidences in the borrower's credit file.
	last_pymnt_d	The month of the last payment received.
	total_pymnt	The total amount received in payments.
	out_prncp	The remaining outstanding principal amount of the loan.

OBJECTIVES:

1) The Loan Performance Analysis report aims to provide insights into the performance of loans based on various factors such as loan amount, loan status, term, interest rate, and purpose.

2) The Borrower Profile Analysis report aims to provide insights into the characteristics of borrowers such as home ownership, annual income, employment length, verification status, debt-to-income ratio, and delinquency history.

CHAPTER - III

METHODOLOGY:

1) Importing Data

Import the "LoanDetails" and "BorrowerDetails" sheets from the "bank loan.xlsx" file into Power BI.

2) Transformation Using Power Query

Data Cleaning:

Handling Missing Values and Duplicates:

1. Replace missing values (null) in the 'emp_length' column of the "BorrowerDetails" table with '0 year'.
2. Remove rows with missing values in the 'last_pymnt_d' and 'delinq_2yrs' columns.
3. Remove duplicate rows in the 'id' column of the "LoanDetails" table.

Dealing with Inconsistencies:

4. Ensure words in the 'purpose' column are separated by spaces instead of underscores (e.g., "credit card" instead of "credit_card").
5. Format the 'purpose' and 'home_ownership' columns to proper case.

Data Transformation:

Column Transformation:

6. Change the data type of the 'total_pymnt' column to 'Fixed decimal number'.
7. Round off the numbers in the 'funded_amnt' column to 2 decimal places.

Column Renaming:

8. Rename the column 'issue_d' to 'issue_date'.
9. Rename the column 'last_pymnt_d' to 'last_pymnt_date'.

Creating New Columns:

10. Create a new custom column named 'total_amount_paid' to calculate the total amount paid by each borrower by subtracting 'out_prncp' from 'total_pymnt'.
11. Add a new conditional column named 'delinquency_status' to identify if the borrower has any delinquencies. If the number of delinquencies in 'delinq_2yrs' is greater than 0, the status should be "Delinquent", otherwise "Not Delinquent".

Column Dropping:

12. Remove the 'sub_grade' column as that does not significantly contribute to the analysis.

3) Data Modeling:

13. Identify the common column between both the tables and establish relationships between the two tables. Ensure the cross-filter direction is set to "Both". This step is crucial for enabling cross-table analysis and ensuring data integrity within the dataset.

4) Creating Measures and Calculated Columns using DAX

14. Create a new calculated column named 'remaining_installments' using DAX in the "BorrowerDetails" table to calculate the number of remaining installments by dividing the remaining principal amount ('out_prncp') by the monthly installment amount ('installment') and round up the result using the CEILING() function to account for any partial payments.
15. Create a measure named 'Non-Verified Borrowers Count' using DAX to count the number of loans that have been 'Not Verified'.
16. Create a measure named 'Fully Paid Loan Percentage' to calculate the percentage of fully paid loans. Divide the number of loans with a "Fully Paid" loan status by the total number of loans and then format this measure as Percentage.

Report 1: Loan Performance Analysis

The Loan Performance Analysis report aims to provide insights into the performance of loans based on various factors such as loan amount, loan status, term, interest rate, and purpose.

1) **Total Funded Amount**: Create a card visual to display the total funded amount.
2) **Fully Paid Loan Percentage**: Create a gauge chart to display the 'Fully Paid Loan Percentage' measure.
3) **Average Interest Rate by Term:** Create a multi-row card to show the average interest rate for each term.
4) **Loan Status Distribution**: Create a pie chart to visualize the sum of total payments by loan status.
5) **Loan Amount by Purpose**: Create a treemap to show the average loan amount by purpose.
6) **Installment Over Time:** Create a line chart to visualize the sum of installments by Year and Quarter of the issue date.

7) **Maximum Total Amount Paid by Loan Status:** Create a column chart to display the maximum total amount paid by loan status.

8) **Minimum Annual Income by Grade:** Create a funnel chart to show the minimum annual income by grade.

9) **Issue Date Slicer:** Add a slicer for the Month of the issue date to enable dynamic data exploration.

Report 2: Borrower Profile Analysis

The Borrower Profile Analysis report aims to provide insights into the characteristics of borrowers such as home ownership, annual income, employment length, verification status, debt-to-income ratio, and delinquency history.

1) **KPI Visual:** Create a KPI visual with the sum of total payment as the value, the year of last payment date as the trend axis, and the sum of loan amount as the target. Round off to 2 decimal points and format as $ currency.

2) **Average of Annual Income:** Display the average of annual income using a card visual.

3) **Non-Verified Borrowers Count**: Display the count of non-verified borrowers using a card visual.

4) **Average Debt-to-Income by Delinquency Status**: Create a multi-row card to show the average debt-to-income ratio by delinquency status.

5) **Sum of Loan Amount by Home Ownership**: Create a table to show the total loan amount by home ownership.

6) **Average Remaining Principal by Verification Status**: Create a donut chart to display the average remaining outstanding principal by verification status.

7) **Sum of Delinquencies by Home Ownership**: Create a bar chart to show the total number of delinquencies in the past 2 years by home ownership and filter the visual to display only Mortgage, Rent, and Own.

8) **Max Remaining Installments by Employment Length**: Create a treemap to show the maximum remaining installments by employment length.

9) **Total Amount Paid and Funded Amount Over Time**: Create a line chart to display the sum of total amount paid and the sum of funded amount by the year of last payment date.

10) **Purpose Slicer**: Add a slicer for loan purpose to enable dynamic data exploration.

CHAPTER - IV

ANALYSIS AND DATA INSIGHTS:

1) COLLECTING OF DATA:

Import the "LoanDetails" and "BorrowerDetails" sheets from the "bank loan.xlsx" file into Power BI.

https://drive.google.com/uc?export=download&id=1yNL9gfv-DlD3cEW9o2GJvtJ9Bzbm37R7

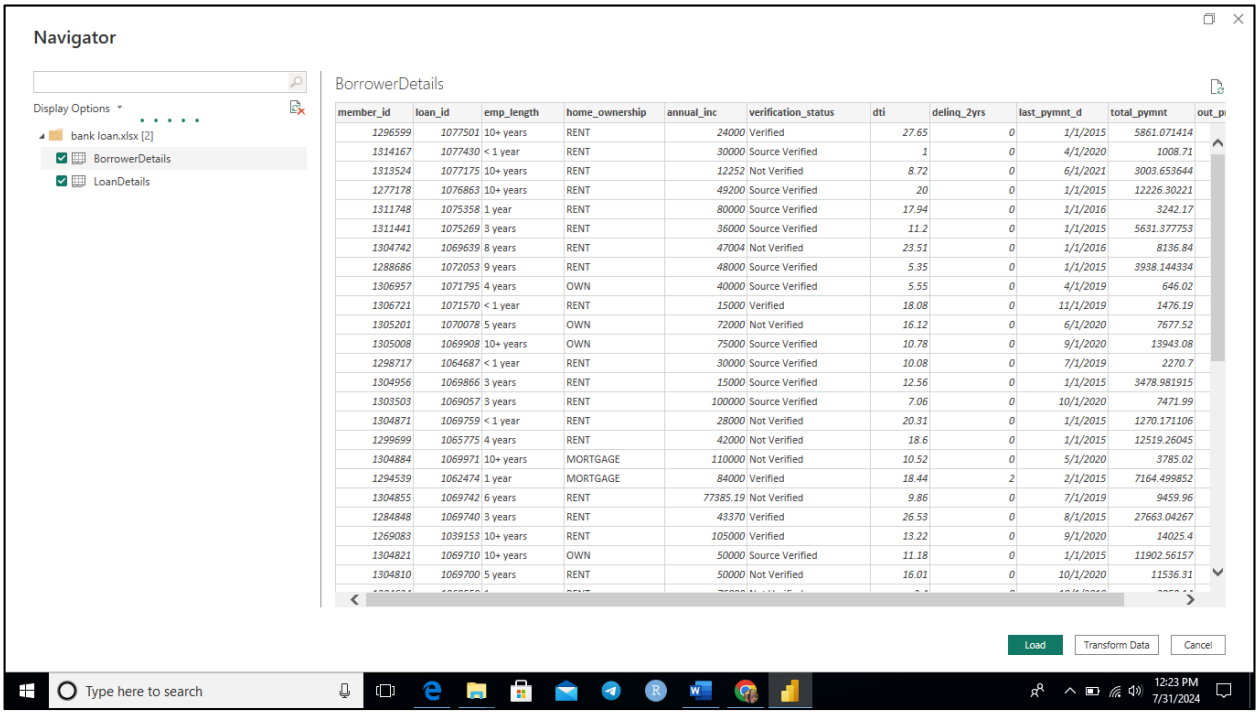


Figure 1.1

2) Transformation Using Power Query

1) Data Cleaning:

Handling Missing Values and Duplicates:

1. Replace missing values (null) in the 'emp_length' column of the "BorrowerDetails" table with '0 year'.

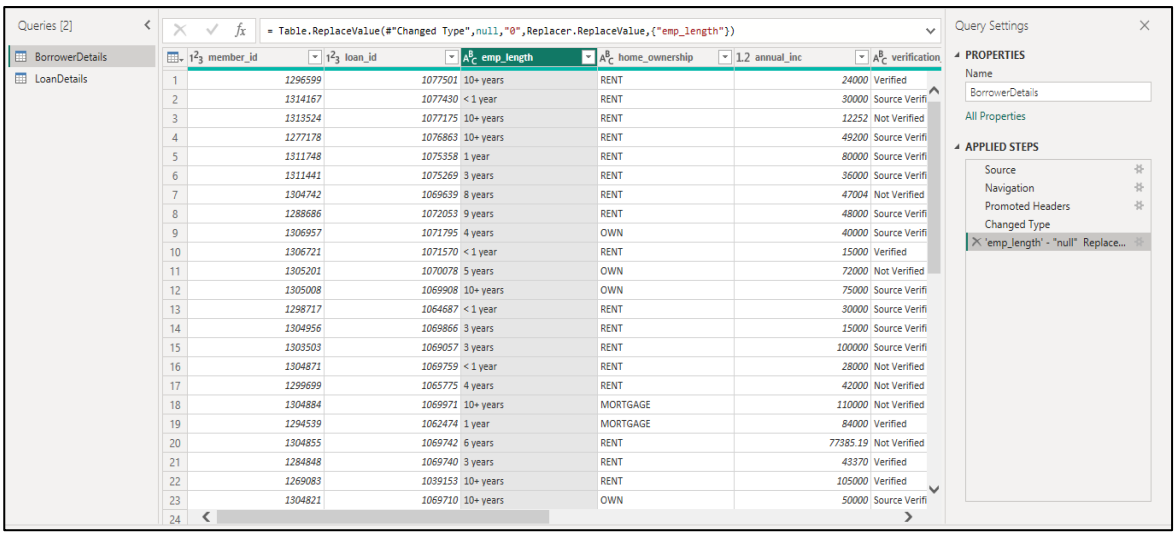


Figure 2.1.1

2. Remove rows with missing values in the 'last_pymnt_d' and 'delinq_2yrs' columns.

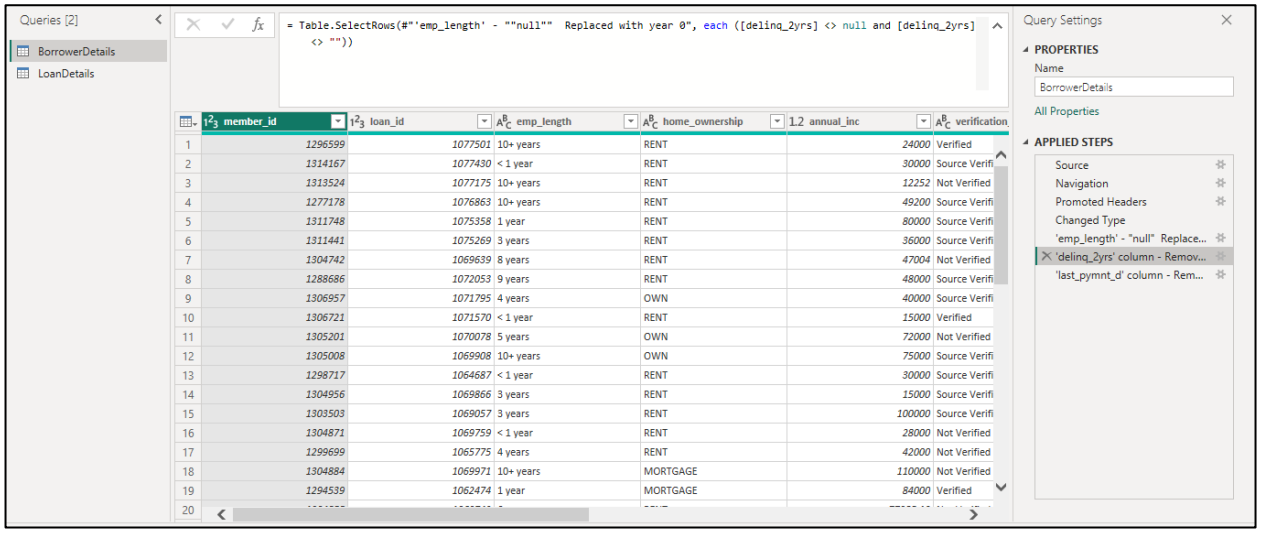


Figure 2.1.2.1

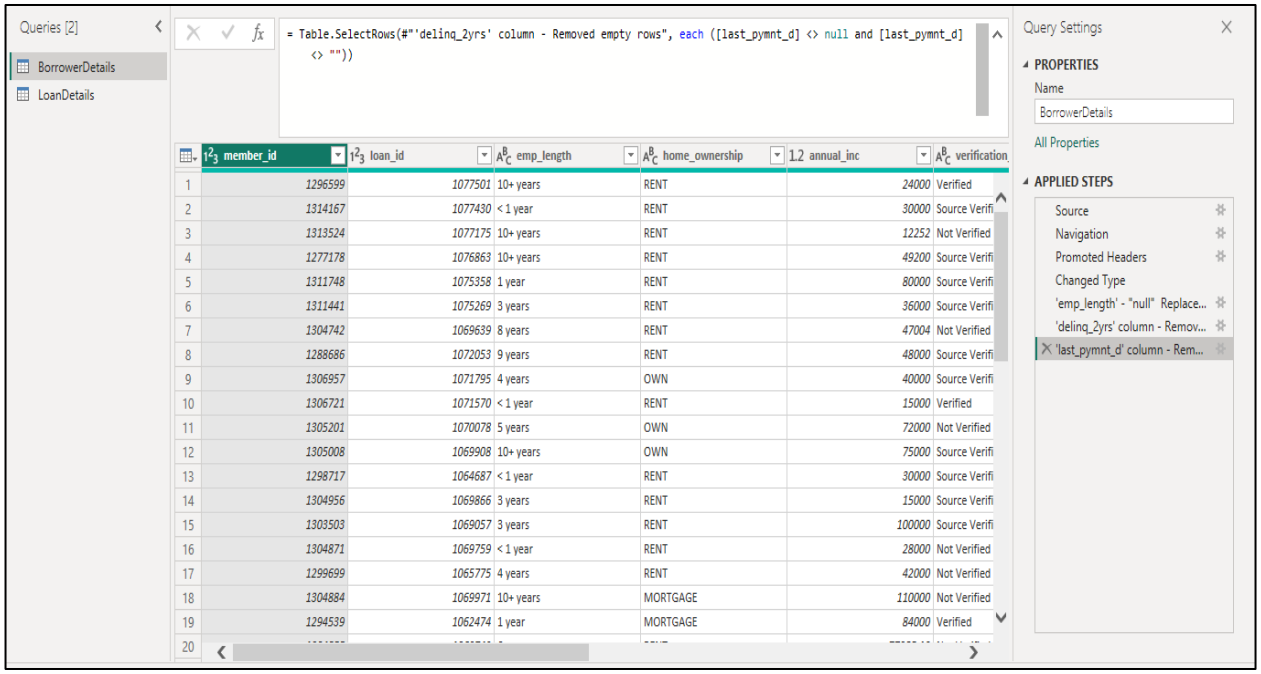


Figure 2.1.2.2

3. Remove duplicate rows in the 'id' column of the "LoanDetails" table.

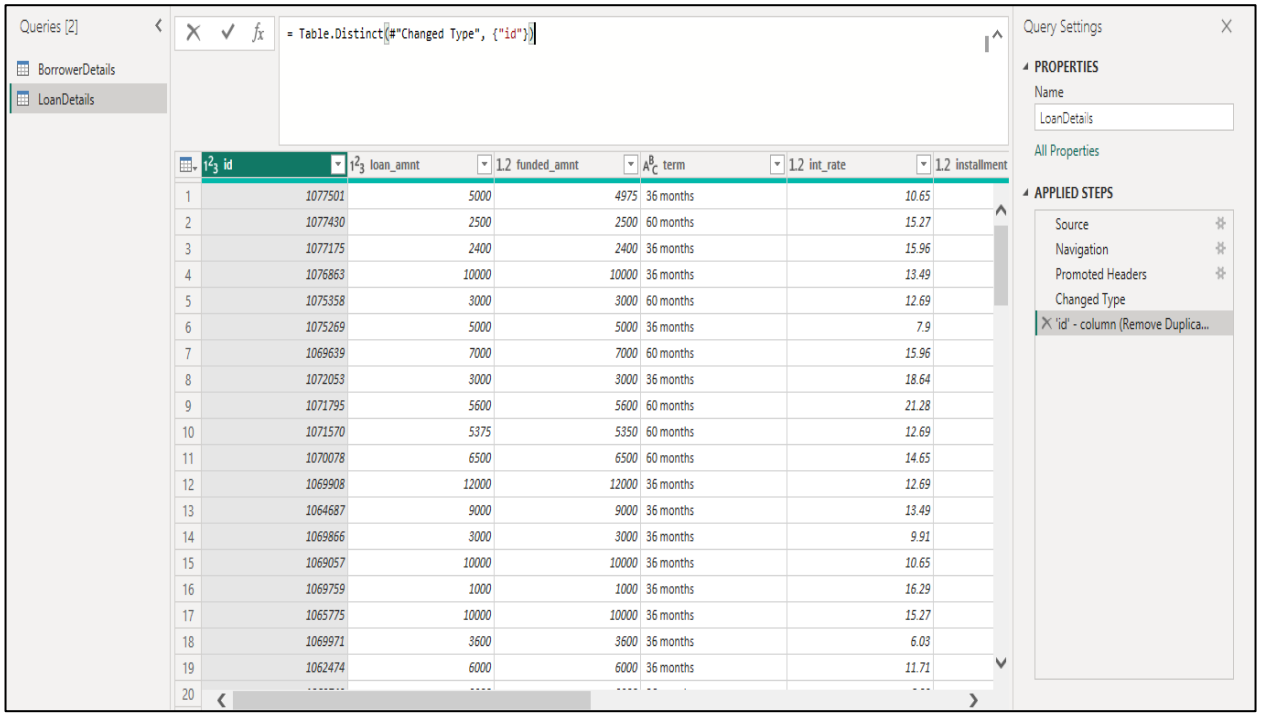
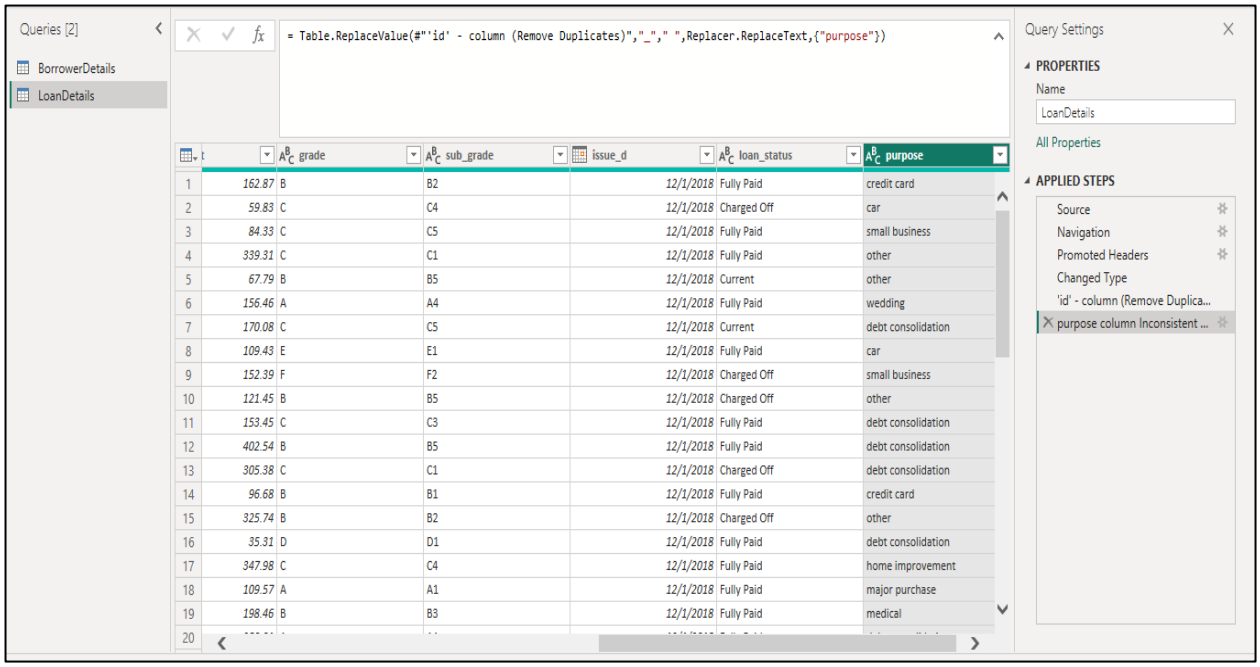


Figure 2.1.3

2) Dealing with Inconsistencies:

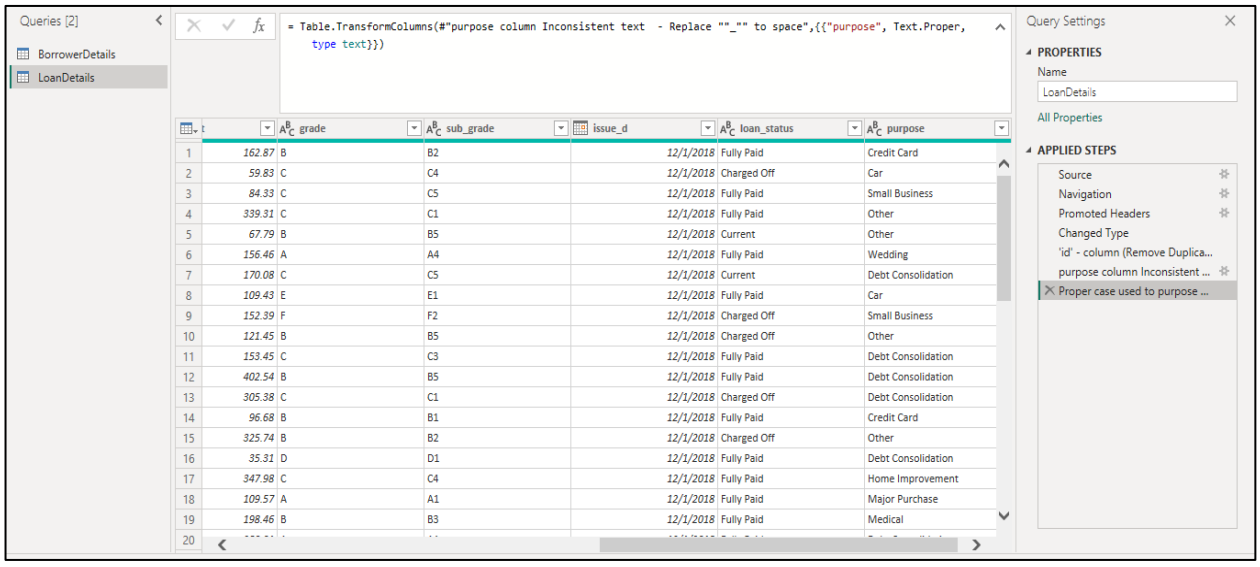
1. Ensure words in the 'purpose' column are separated by spaces instead of underscores (e.g., "credit card" instead of "credit_card").



	t	grade	sub_grade	issue_d	loan_status	purpose
1	162.87	B	B2	12/1/2018	Fully Paid	credit card
2	59.83	C	C4	12/1/2018	Charged Off	car
3	84.33	C	C5	12/1/2018	Fully Paid	small business
4	339.31	C	C1	12/1/2018	Fully Paid	other
5	67.79	B	B5	12/1/2018	Current	other
6	156.46	A	A4	12/1/2018	Fully Paid	wedding
7	170.08	C	C5	12/1/2018	Current	debt consolidation
8	109.43	E	E1	12/1/2018	Fully Paid	car
9	152.39	F	F2	12/1/2018	Charged Off	small business
10	121.45	B	B5	12/1/2018	Charged Off	other
11	153.45	C	C3	12/1/2018	Fully Paid	debt consolidation
12	402.54	B	B5	12/1/2018	Fully Paid	debt consolidation
13	305.38	C	C1	12/1/2018	Charged Off	debt consolidation
14	96.68	B	B1	12/1/2018	Fully Paid	credit card
15	325.74	B	B2	12/1/2018	Charged Off	other
16	35.31	D	D1	12/1/2018	Fully Paid	debt consolidation
17	347.98	C	C4	12/1/2018	Fully Paid	home improvement
18	109.57	A	A1	12/1/2018	Fully Paid	major purchase
19	198.46	B	B3	12/1/2018	Fully Paid	medical
20						

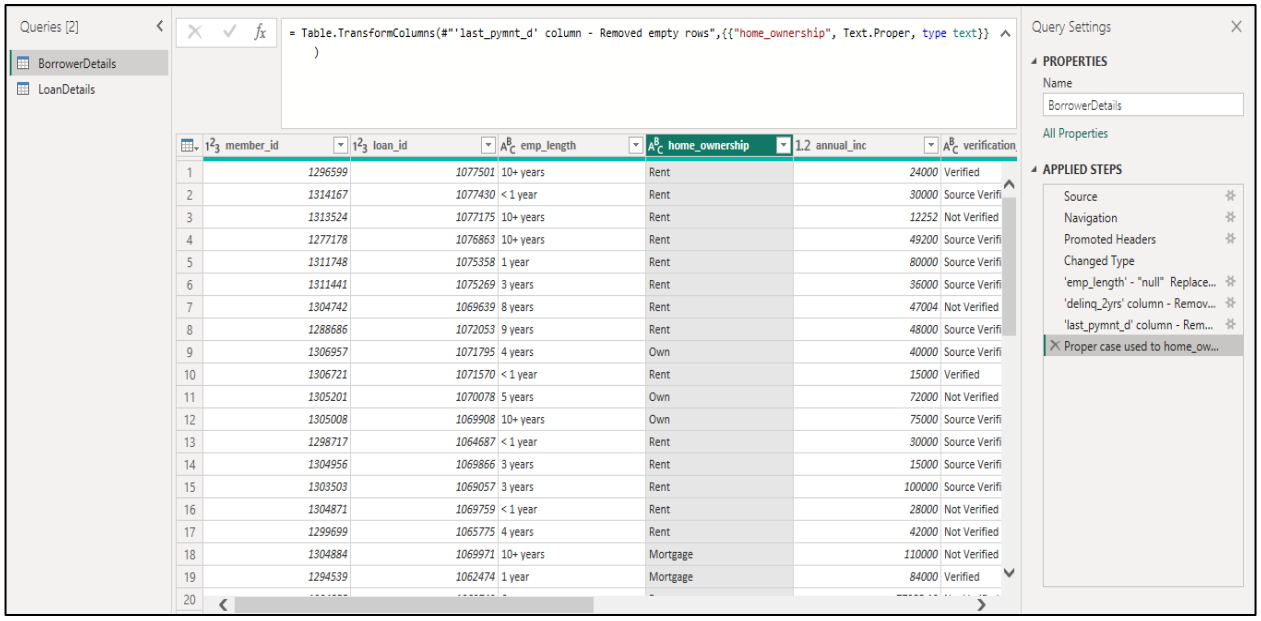
Figure 2.2.1

2. Format the 'purpose' and 'home_ownership' columns to proper case.



	t	grade	sub_grade	issue_d	loan_status	purpose
1	162.87	B	B2	12/1/2018	Fully Paid	Credit Card
2	59.83	C	C4	12/1/2018	Charged Off	Car
3	84.33	C	C5	12/1/2018	Fully Paid	Small Business
4	339.31	C	C1	12/1/2018	Fully Paid	Other
5	67.79	B	B5	12/1/2018	Current	Other
6	156.46	A	A4	12/1/2018	Fully Paid	Wedding
7	170.08	C	C5	12/1/2018	Current	Debt Consolidation
8	109.43	E	E1	12/1/2018	Fully Paid	Car
9	152.39	F	F2	12/1/2018	Charged Off	Small Business
10	121.45	B	B5	12/1/2018	Charged Off	Other
11	153.45	C	C3	12/1/2018	Fully Paid	Debt Consolidation
12	402.54	B	B5	12/1/2018	Fully Paid	Debt Consolidation
13	305.38	C	C1	12/1/2018	Charged Off	Debt Consolidation
14	96.68	B	B1	12/1/2018	Fully Paid	Credit Card
15	325.74	B	B2	12/1/2018	Charged Off	Other
16	35.31	D	D1	12/1/2018	Fully Paid	Debt Consolidation
17	347.98	C	C4	12/1/2018	Fully Paid	Home Improvement
18	109.57	A	A1	12/1/2018	Fully Paid	Major Purchase
19	198.46	B	B3	12/1/2018	Fully Paid	Medical
20						

Figure 2.2.2.1



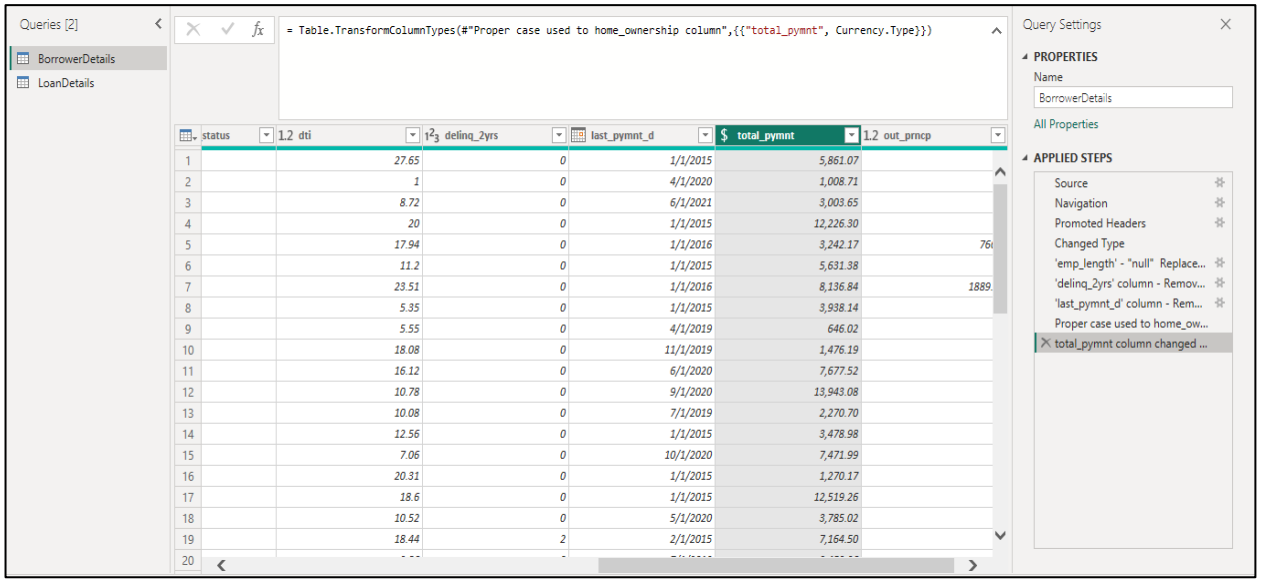
	member_id	loan_id	emp_length	home_ownership	annual_inc	verification
1	1296599	1077501	10+ years	Rent	24000	Verified
2	1314167	1077430	< 1 year	Rent	30000	Source Verifi
3	1313524	1077175	10+ years	Rent	12252	Not Verified
4	1277178	1076863	10+ years	Rent	49200	Source Verifi
5	1311748	1075358	1 year	Rent	80000	Source Verifi
6	1311441	1075269	3 years	Rent	36000	Source Verifi
7	1304742	1069639	8 years	Rent	47004	Not Verified
8	1288686	1072053	9 years	Rent	48000	Source Verifi
9	1306957	1071795	4 years	Own	40000	Source Verifi
10	1306721	1071570	< 1 year	Rent	15000	Verified
11	1305201	1070078	5 years	Own	72000	Not Verified
12	1305008	1069908	10+ years	Own	75000	Source Verifi
13	1298717	1064687	< 1 year	Rent	30000	Source Verifi
14	1304956	1069866	3 years	Rent	15000	Source Verifi
15	1303503	1069057	3 years	Rent	100000	Source Verifi
16	1304871	1069759	< 1 year	Rent	28000	Not Verified
17	1299699	1065775	4 years	Rent	42000	Not Verified
18	1304884	1069971	10+ years	Mortgage	110000	Not Verified
19	1294539	1062474	1 year	Mortgage	84000	Verified
20						

Figure 2.2.2.2

3) Data Transformation:

Column Transformation:

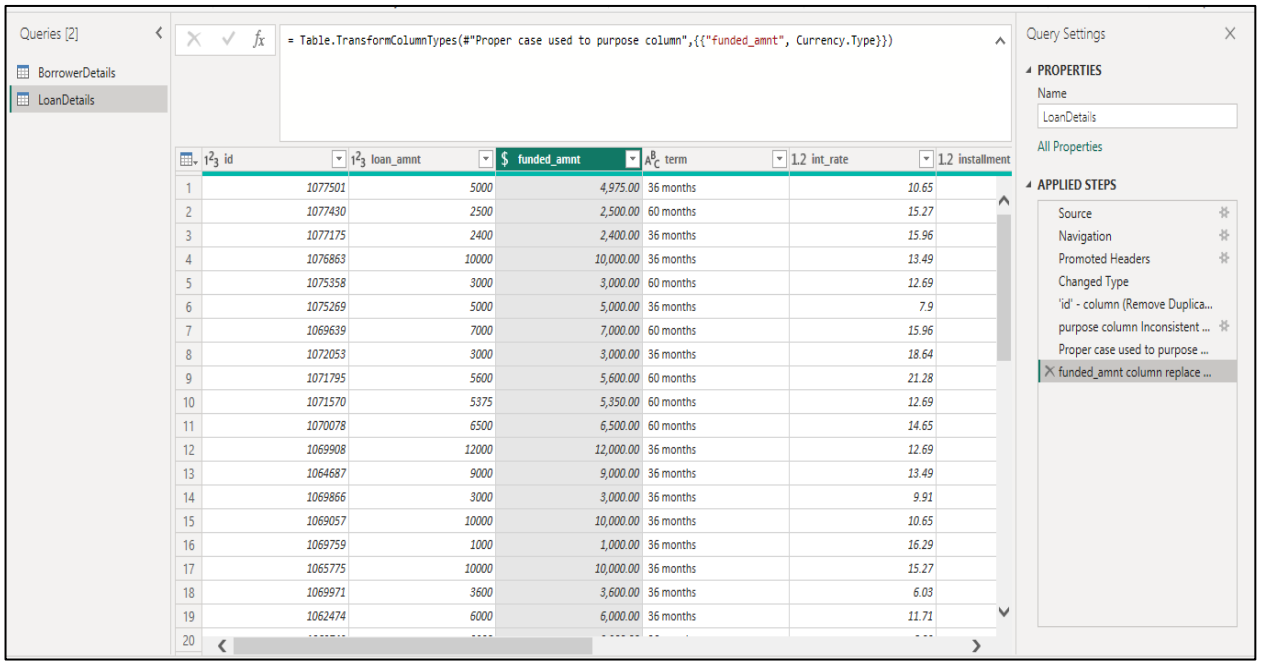
1. Change the data type of the 'total_pymnt' column to 'Fixed decimal number'.



	status	dti	delinq_2yrs	last_pymnt_d	total_pymnt	out_prncp
1		27.65	0	1/1/2015	5,861.07	
2		1	0	4/1/2020	1,008.71	
3		8.72	0	6/1/2021	3,003.65	
4		20	0	1/1/2015	12,226.30	
5		17.94	0	1/1/2016	3,242.17	76
6		11.2	0	1/1/2015	5,631.38	
7		23.51	0	1/1/2016	8,136.84	1889.
8		5.35	0	1/1/2015	3,938.14	
9		5.55	0	4/1/2019	646.02	
10		18.08	0	11/1/2019	1,476.19	
11		16.12	0	6/1/2020	7,677.52	
12		10.78	0	9/1/2020	13,943.08	
13		10.08	0	7/1/2019	2,270.70	
14		12.56	0	1/1/2015	3,478.98	
15		7.06	0	10/1/2020	7,471.99	
16		20.31	0	1/1/2015	1,270.17	
17		18.6	0	1/1/2015	12,519.26	
18		10.52	0	5/1/2020	3,785.02	
19		18.44	2	2/1/2015	7,164.50	
20						

Figure 2.3.1

2. Round off the numbers in the 'funded_amnt' column to 2 decimal places.

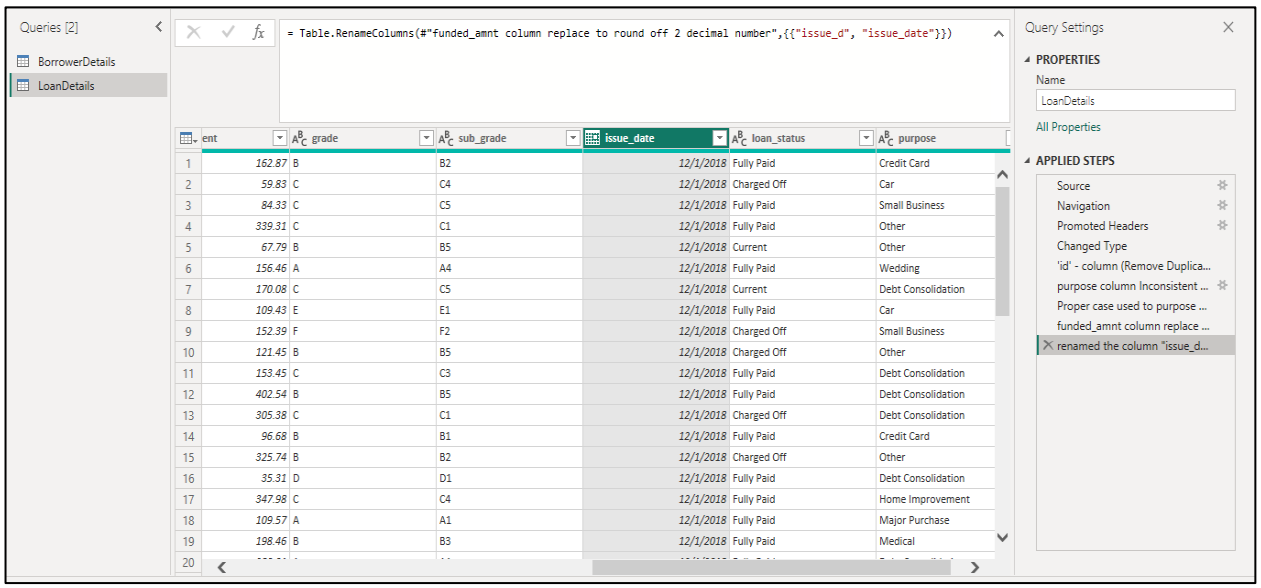


	id	loan_amnt	funded_amnt	term	int_rate	installment
1	1077501	5000	4,975.00	36 months	10.65	
2	1077430	2500	2,500.00	60 months	15.27	
3	1077175	2400	2,400.00	36 months	15.96	
4	1076863	10000	10,000.00	36 months	13.49	
5	1075358	3000	3,000.00	60 months	12.69	
6	1075269	5000	5,000.00	36 months	7.9	
7	1069639	7000	7,000.00	60 months	15.96	
8	1072053	3000	3,000.00	36 months	18.64	
9	1071795	5600	5,600.00	60 months	21.28	
10	1071570	5375	5,350.00	60 months	12.69	
11	1070078	6500	6,500.00	60 months	14.65	
12	1069908	12000	12,000.00	36 months	12.69	
13	1064687	9000	9,000.00	36 months	13.49	
14	1069866	3000	3,000.00	36 months	9.91	
15	1069057	10000	10,000.00	36 months	10.65	
16	1069759	1000	1,000.00	36 months	16.29	
17	1065775	10000	10,000.00	36 months	15.27	
18	1069971	3600	3,600.00	36 months	6.03	
19	1062474	6000	6,000.00	36 months	11.71	
20						

Figure 2.3.2

Column Renaming:

3. Rename the column 'issue_d' to 'issue_date'.



	ent	grade	sub_grade	issue_date	loan_status	purpose
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8	109.43	E	E1	12/1/2018	Fully Paid	Car
9	152.39	F	F2	12/1/2018	Charged Off	Small Business
10	121.45	B	B5	12/1/2018	Charged Off	Other
11	153.45	C	C3	12/1/2018	Fully Paid	Debt Consolidation
12	402.54	B	B5	12/1/2018	Fully Paid	Debt Consolidation
13	305.38	C	C1	12/1/2018	Charged Off	Debt Consolidation
14	96.68	B	B1	12/1/2018	Fully Paid	Credit Card
15	325.74	B	B2	12/1/2018	Charged Off	Other
16	35.31	D	D1	12/1/2018	Fully Paid	Debt Consolidation
17	347.98	C	C4	12/1/2018	Fully Paid	Home Improvement
18	109.57	A	A1	12/1/2018	Fully Paid	Major Purchase
19	198.46	B	B3	12/1/2018	Fully Paid	Medical
20						

Figure 2.3.3

4. Rename the column 'last_pymnt_d' to 'last_pymnt_date'.

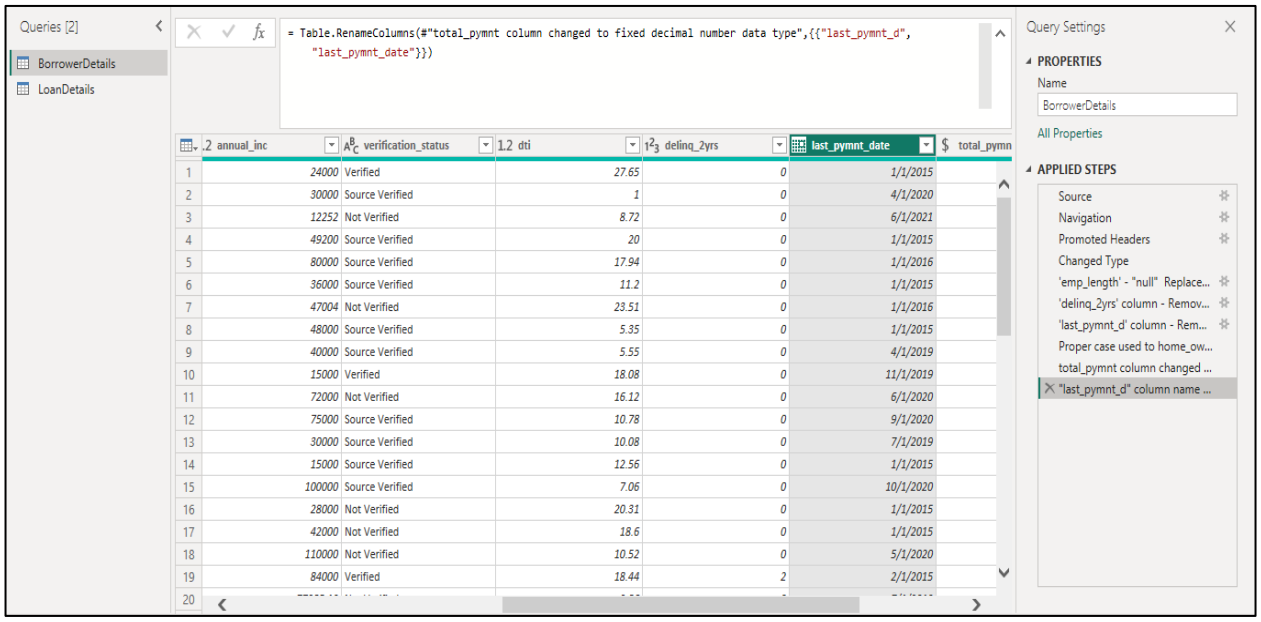


Figure 2.3.4

Creating New Columns:

5. Create a new custom column named 'total_amount_paid' to calculate the total amount paid by each borrower by subtracting 'out_prncp' from 'total_pymnt'.

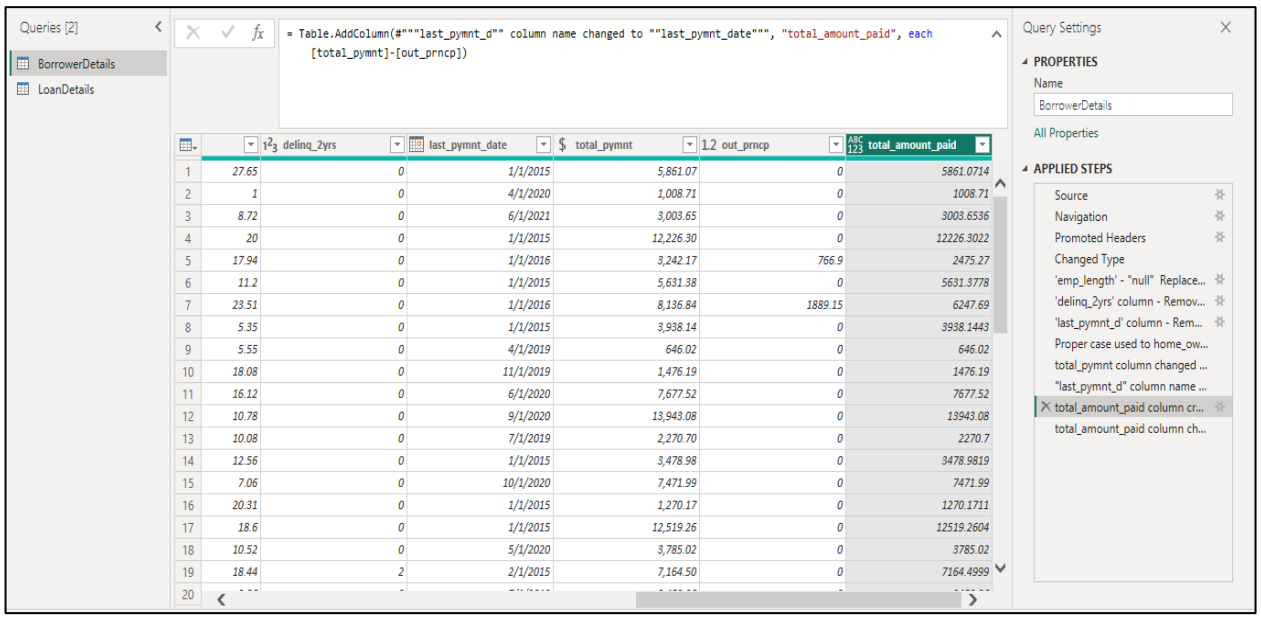
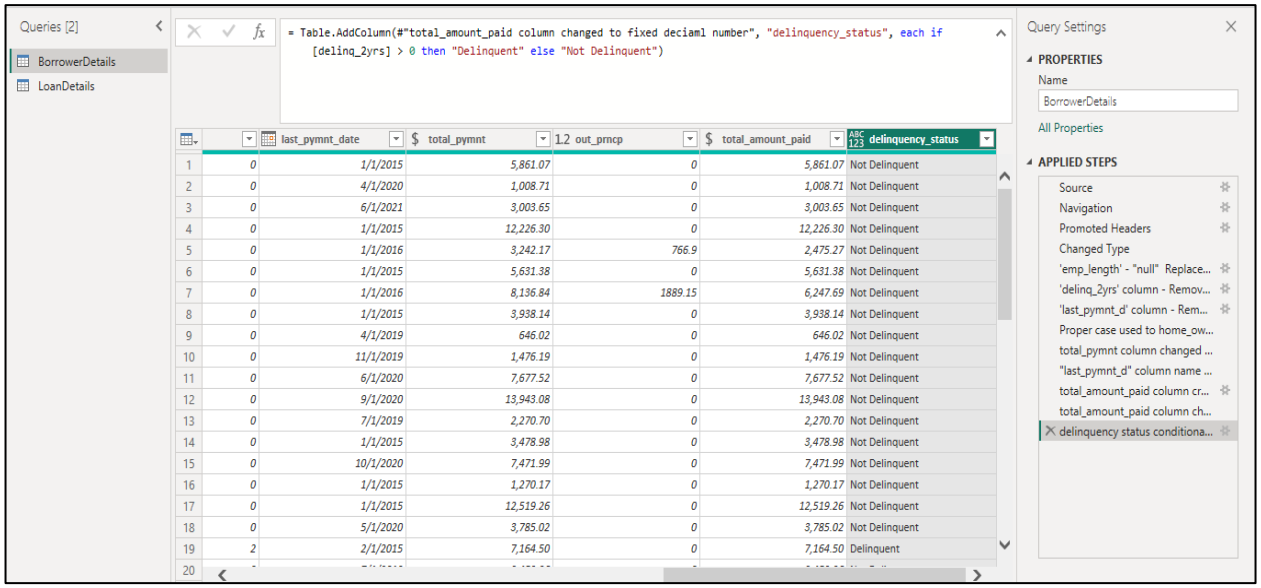


Figure 2.3.5

6. Add a new conditional column named 'delinquency_status' to identify if the borrower has any delinquencies. If the number of delinquencies in 'delinq_2yrs' is greater than 0, the status should be "Delinquent", otherwise "Not Delinquent".

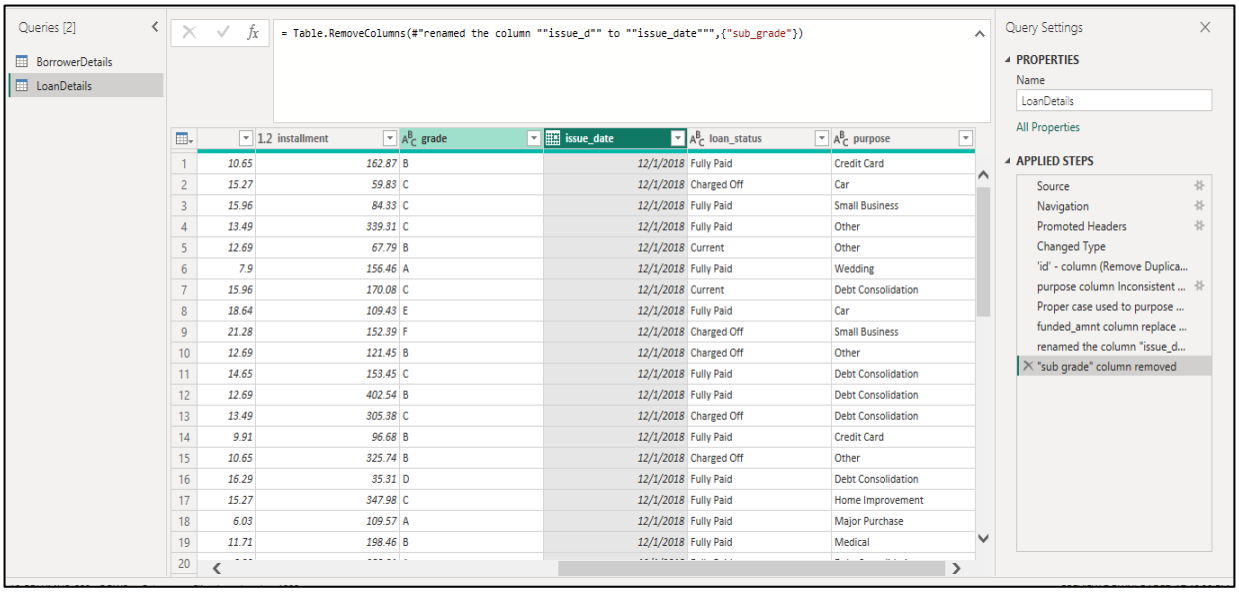


	last_pymnt_date	total_pymnt	out_prncp	total_amount_paid	delinquency_status
1	0	1/1/2015	5,861.07	0	5,861.07	Not Delinquent
2	0	4/1/2020	1,008.71	0	1,008.71	Not Delinquent
3	0	6/1/2021	3,003.65	0	3,003.65	Not Delinquent
4	0	1/1/2015	12,226.30	0	12,226.30	Not Delinquent
5	0	1/1/2016	3,242.17	766.9	2,475.27	Not Delinquent
6	0	1/1/2015	5,631.38	0	5,631.38	Not Delinquent
7	0	1/1/2016	8,136.84	1889.15	6,247.69	Not Delinquent
8	0	1/1/2015	3,938.14	0	3,938.14	Not Delinquent
9	0	4/1/2019	646.02	0	646.02	Not Delinquent
10	0	11/1/2019	1,476.19	0	1,476.19	Not Delinquent
11	0	6/1/2020	7,677.52	0	7,677.52	Not Delinquent
12	0	9/1/2020	13,943.08	0	13,943.08	Not Delinquent
13	0	7/1/2019	2,270.70	0	2,270.70	Not Delinquent
14	0	1/1/2015	3,478.98	0	3,478.98	Not Delinquent
15	0	10/1/2020	7,471.99	0	7,471.99	Not Delinquent
16	0	1/1/2015	1,270.17	0	1,270.17	Not Delinquent
17	0	1/1/2015	12,519.26	0	12,519.26	Not Delinquent
18	0	5/1/2020	3,785.02	0	3,785.02	Not Delinquent
19	2	2/1/2015	7,164.50	0	7,164.50	Delinquent
20						

Figure 2.3.6

Column Dropping:

7. Remove the 'sub_grade' column as that does not significantly contribute to the analysis.



	installment	grade	issue_date	loan_status	purpose
1	10.65	162.87	B	12/1/2018	Fully Paid	Credit Card
2	15.27	59.83	C	12/1/2018	Charged Off	Car
3	15.96	84.33	C	12/1/2018	Fully Paid	Small Business
4	13.49	339.31	C	12/1/2018	Fully Paid	Other
5	12.69	67.79	B	12/1/2018	Current	Other
6	7.9	156.46	A	12/1/2018	Fully Paid	Wedding
7	15.96	170.08	C	12/1/2018	Current	Debt Consolidation
8	18.64	109.43	E	12/1/2018	Fully Paid	Car
9	21.28	152.39	F	12/1/2018	Charged Off	Small Business
10	12.69	121.45	B	12/1/2018	Charged Off	Other
11	14.65	153.45	C	12/1/2018	Fully Paid	Debt Consolidation
12	12.69	402.54	B	12/1/2018	Fully Paid	Debt Consolidation
13	13.49	305.38	C	12/1/2018	Charged Off	Debt Consolidation
14	9.91	96.68	B	12/1/2018	Fully Paid	Credit Card
15	10.65	325.74	B	12/1/2018	Charged Off	Other
16	16.29	35.31	D	12/1/2018	Fully Paid	Debt Consolidation
17	15.27	347.98	C	12/1/2018	Fully Paid	Home Improvement
18	6.03	109.57	A	12/1/2018	Fully Paid	Major Purchase
19	11.71	198.46	B	12/1/2018	Fully Paid	Medical
20						

Figure 2.3.7

3) Data Modeling:

Identify the common column between both the tables and establish relationships between the two tables. Ensure the cross-filter direction is set to "Both". This step is crucial for enabling cross-table analysis and ensuring data integrity within the dataset.

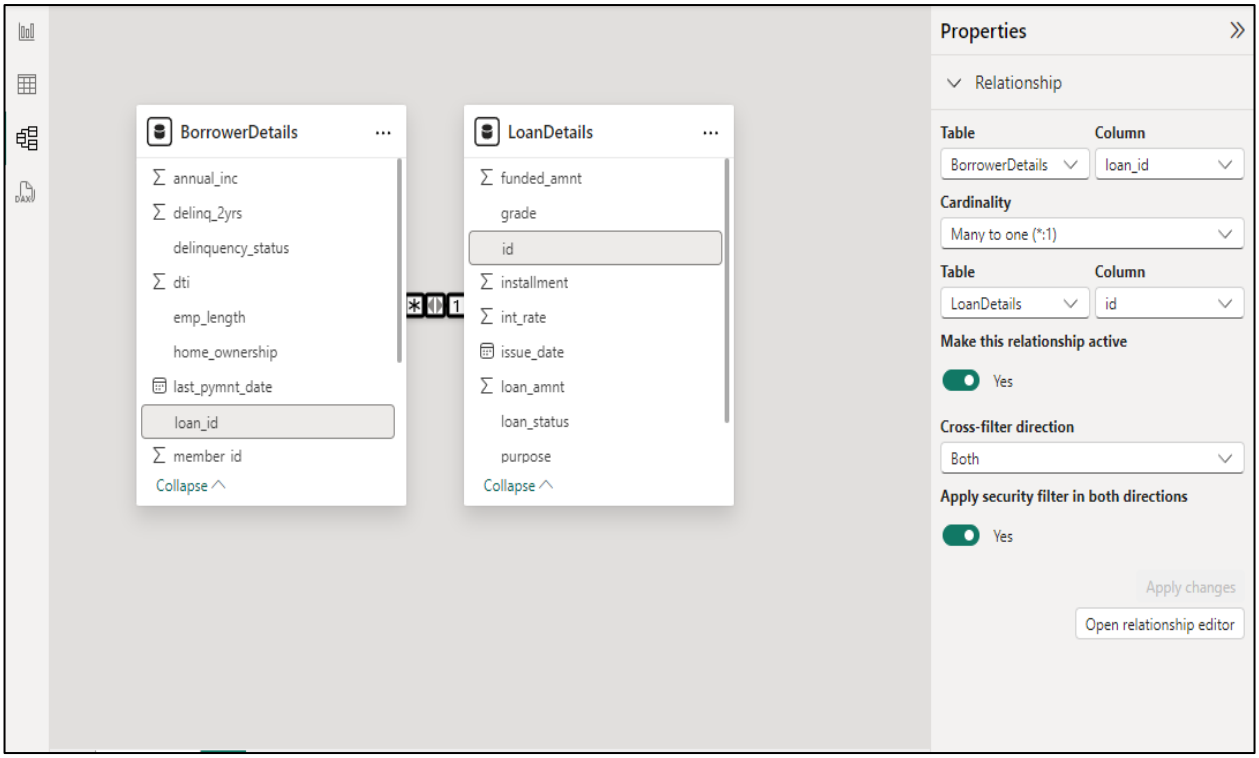


Figure 3.1

The relationship between the Loan Details table and the Borrower Details table exhibits a many-to-one cardinality, as identified in the provided **figure 3.1**. This relationship is a key aspect of data modeling.

4) Creating Measures and Calculated Columns using DAX:

1. Create a new calculated column named 'remaining_installments' using DAX in the "BorrowerDetails" table to calculate the number of remaining installments by dividing the remaining principal amount ('out_prncp') by the monthly installment amount ('installment') and round up the result using the CEILING() function to account for any partial payments.

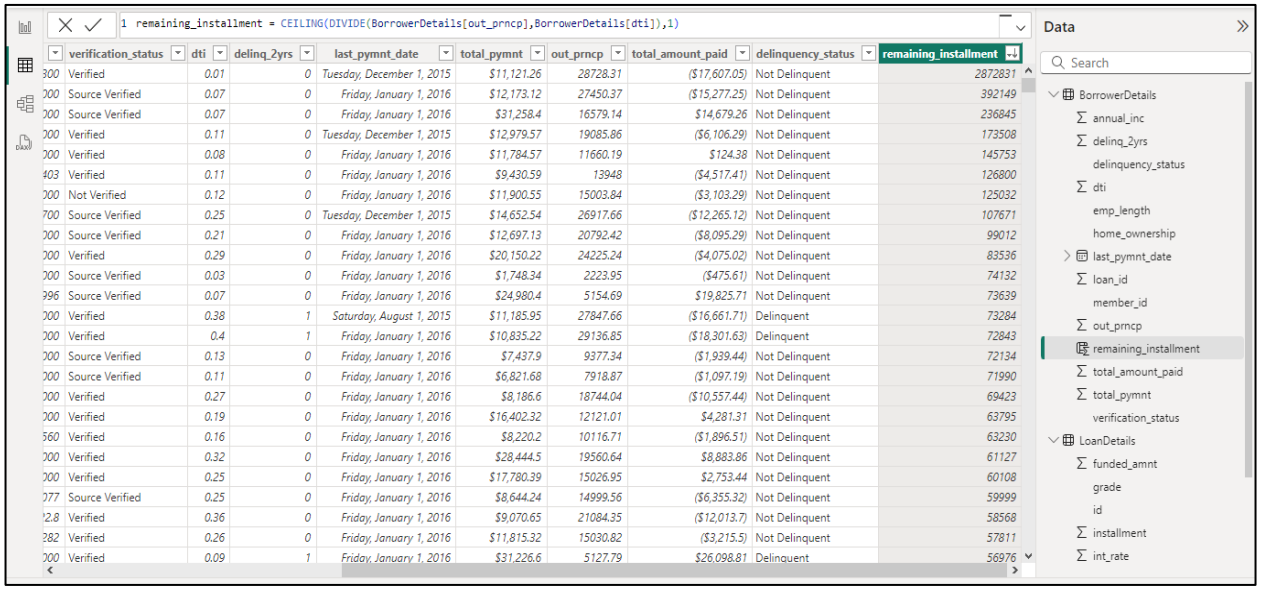


Figure 4.1

DAX FUNCTION:

remaining_installment = CEILING(DIVIDE(BorrowerDetails[out_prncp],BorrowerDetails[dti]),1)

In essence, the DAX code determines how many installments are left for each borrower by considering their current outstanding principal, monthly installment amount, and any partial payments they have made.

2. Create a measure named 'Non-Verified Borrowers Count' using DAX to count the number of loans that have been 'Not Verified'.

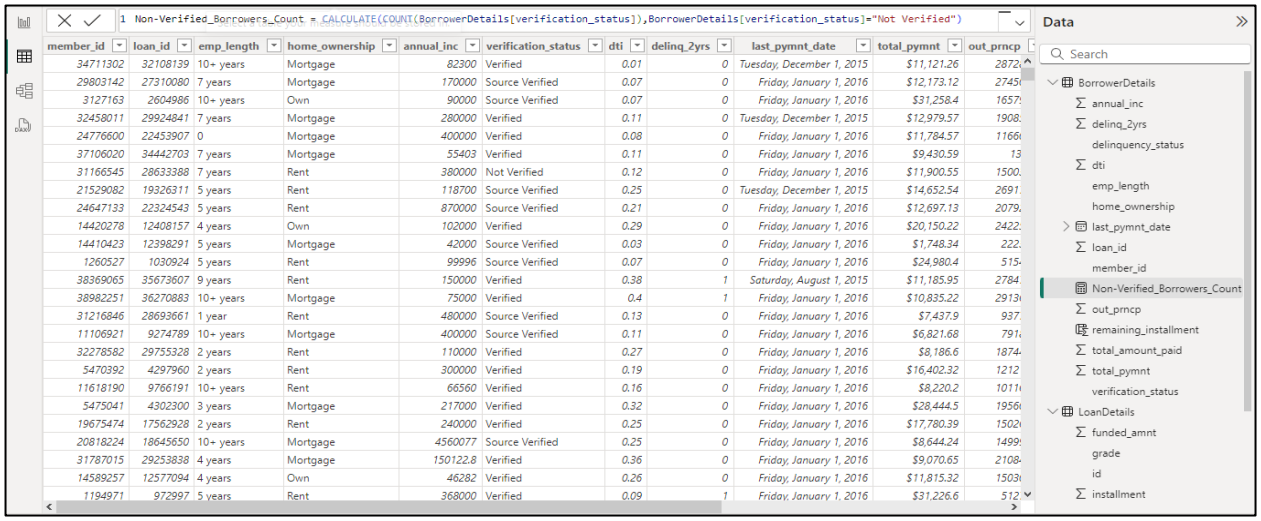


Figure 4.2.1

DAX FUNCTION:

Non-Verified_Borrowers_Count=

CALCULATE(COUNT(BorrowerDetails[verification_status]),BorrowerDetails[verification_status]="Not Verified")

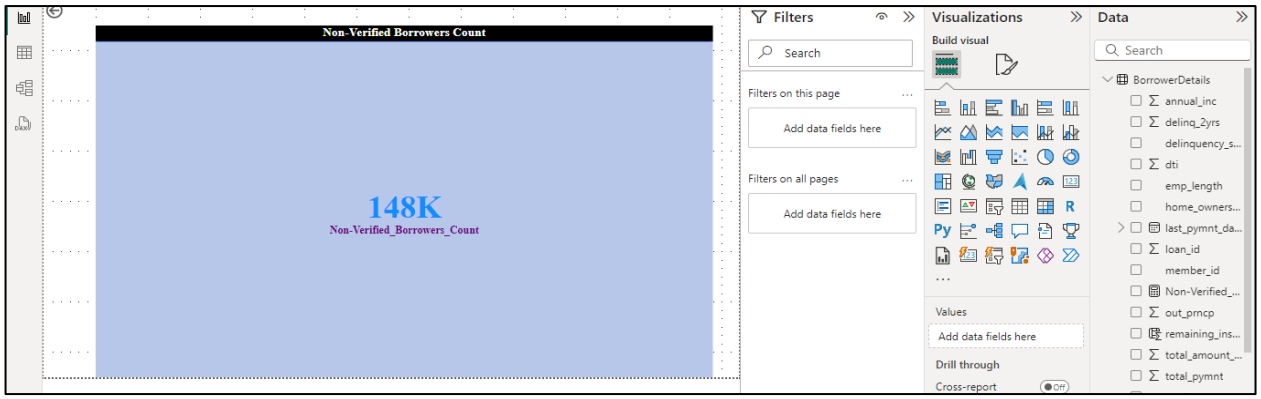


Figure 4.2.2

Applying this measure to your data will count the loans with the status "Not Verified." In this instance, the measure returns a total of 148,000, indicating that there are 148,000 loans that remain unverified.

3. Create a measure named 'Fully Paid Loan Percentage' to calculate the percentage of fully paid loans. Divide the number of loans with a "Fully Paid" loan status by the total number of loans and then format this measure as Percentage.

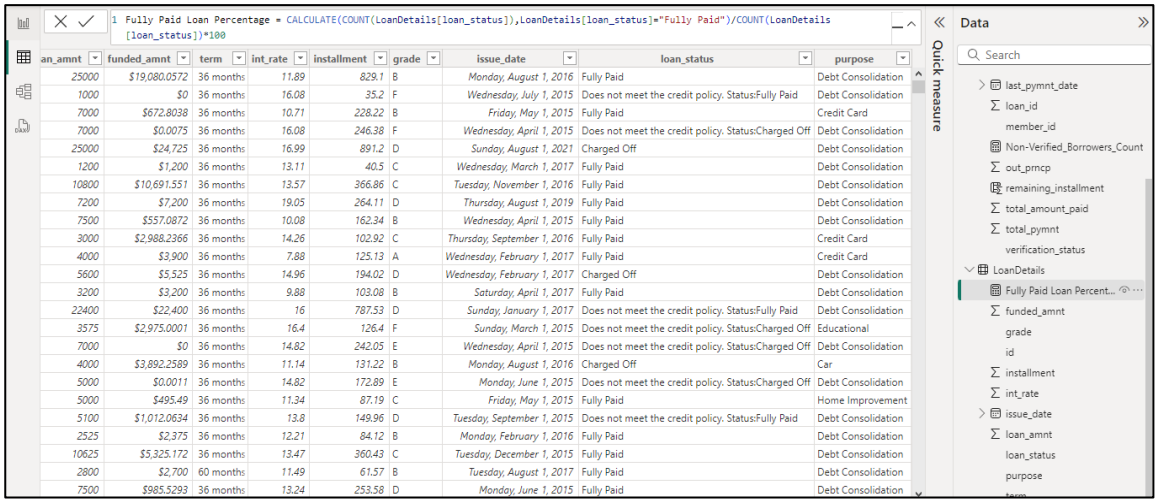


Figure 4.3.1

DAX FUNCTION:

Fully Paid Loan Percentage =
CALCULATE(COUNT(LoanDetails[loan_status]),LoanDetails[loan_status]="Fully Paid")/COUNT(LoanDetails[loan_status])*100

Figure 4.3.2

The 'Fully Paid Loan Percentage' measure tells you what fraction of your loans have been fully paid off. It works by taking the number of loans marked as "Fully Paid" and dividing it by the total number of loans, then expressing the result as a percentage. In this instance, it shows that 40% of the loans are fully paid.

5) Report 1: Loan Performance Analysis:

The Loan Performance Analysis report aims to provide insights into the performance of loans based on various factors such as loan amount, loan status, term, interest rate, and purpose.

1. **Total Funded Amount**: Create a card visual to display the total funded amount.

Figure 5.1

The card visual shows the total funded amount as $6,630.19.

2. **Fully Paid Loan Percentage**: Create a gauge chart to display the 'Fully Paid Loan Percentage' measure.

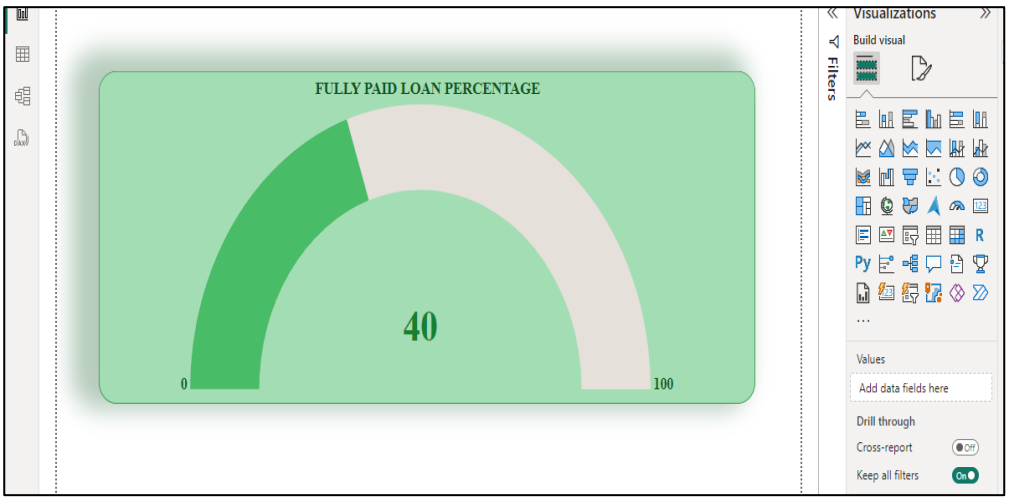


Figure 5.2

The gauge chart illustrates the 'Fully Paid Loan Percentage,' which stands at 40%.

3. **Average Interest Rate by Term:** Create a multi-row card to show the average interest rate for each term.

Figure 5.3

The average interest rates for loans with terms of 36 months and 60 months were found to be 12.64% and 16.96%, respectively.

4. **Loan Status Distribution**: Create a pie chart to visualize the sum of total payments by loan status.

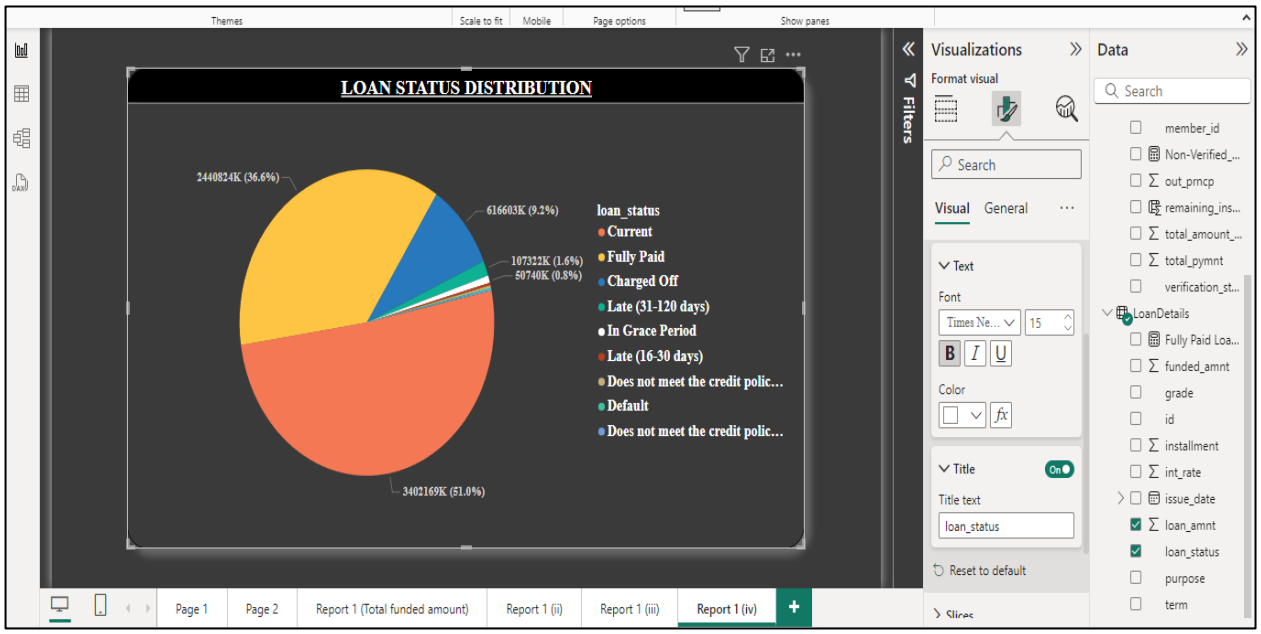


Figure 5.4

The pie chart shows the distribution of total payments by loan status. The majority of borrowers (51%) have current loans, followed by those who have fully paid their loans (36.6%). A smaller percentage of borrowers have charged-off loans (9.2%). The remaining borrowers are categorized as late (31-120 days), in grace period, late (16-30 days), do not meet the credit policy and are in default (3.2%).

5. **Loan Amount by Purpose**: Create a treemap to show the average loan amount by purpose.

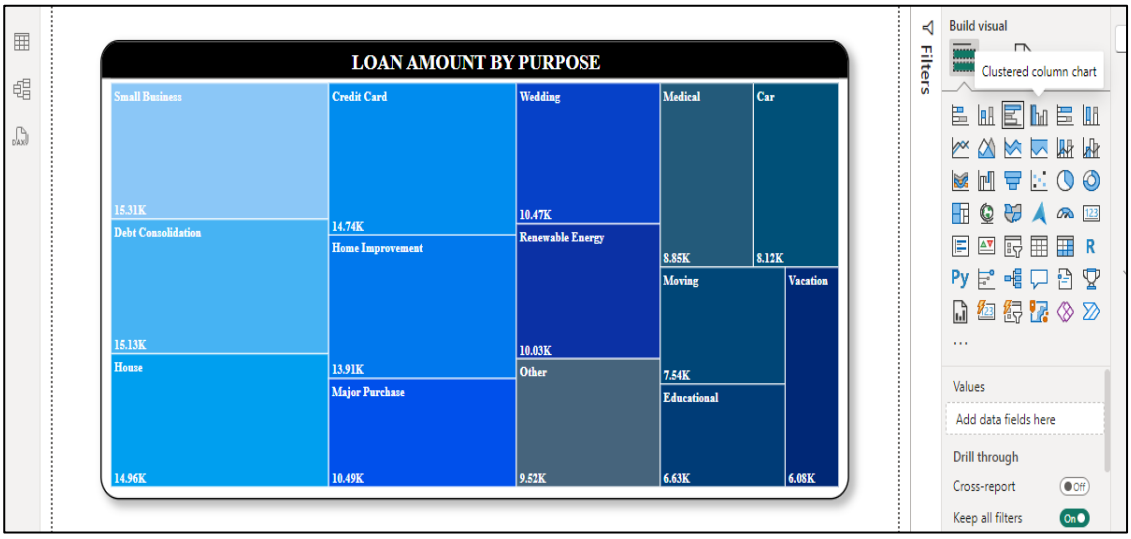


Figure 5.5

The treemap reveals that small business loans have the highest average loan amounts, followed by debt consolidation loans. Home loans, credit loans, and home improvement loans also hold significant average loan amounts. Other loan purposes, such as major purchases, weddings, renewable energy, other expenses, medical expenses, moving costs, educational expenses, car purchases, and vacations, generally have lower average loan amounts.

6. **Installment Over Time:** Create a line chart to visualize the sum of installments by Year and Quarter of the issue date.

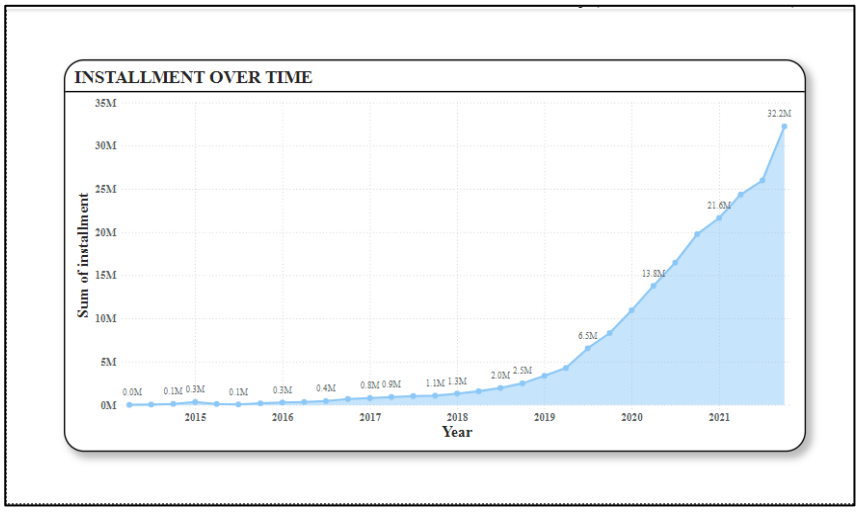


Figure 5.6

This line chart illustrates the trend in total installments paid over time. The chart reveals a clear upward trend, indicating that the total amount of installments has been increasing year by year.

7. **Maximum Total Amount Paid by Loan Status:** Create a column chart to display the maximum total amount paid by loan status.

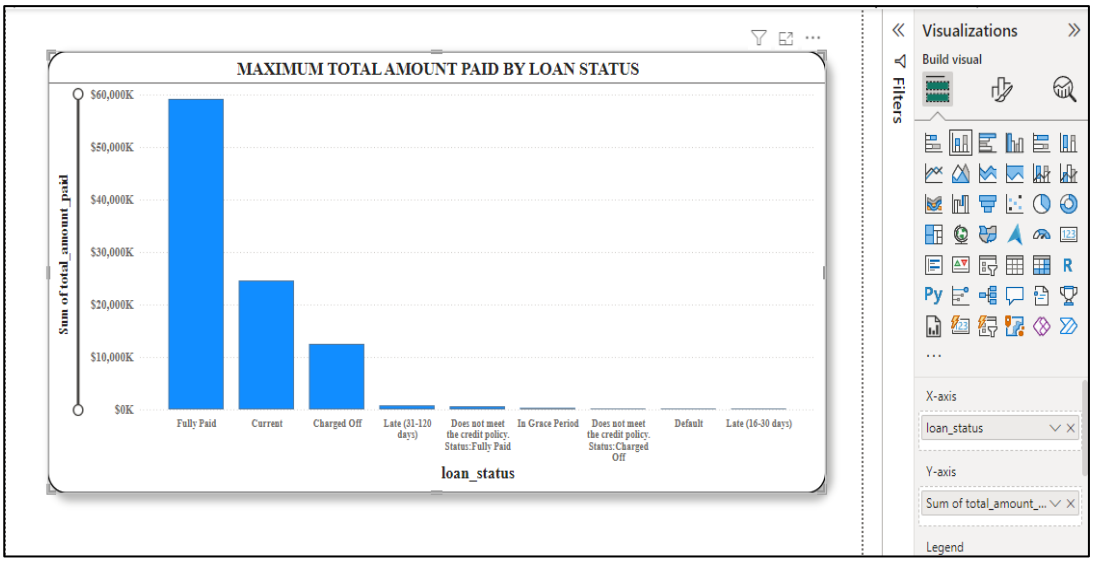


Figure 5.7

The bar chart indicates that the highest total amount of payments is associated with fully paid loans, followed by current loans. Charged-off loans represent a lower total amount of payments.

8. **Minimum Annual Income by Grade:** Create a funnel chart to show the minimum annual income by grade.

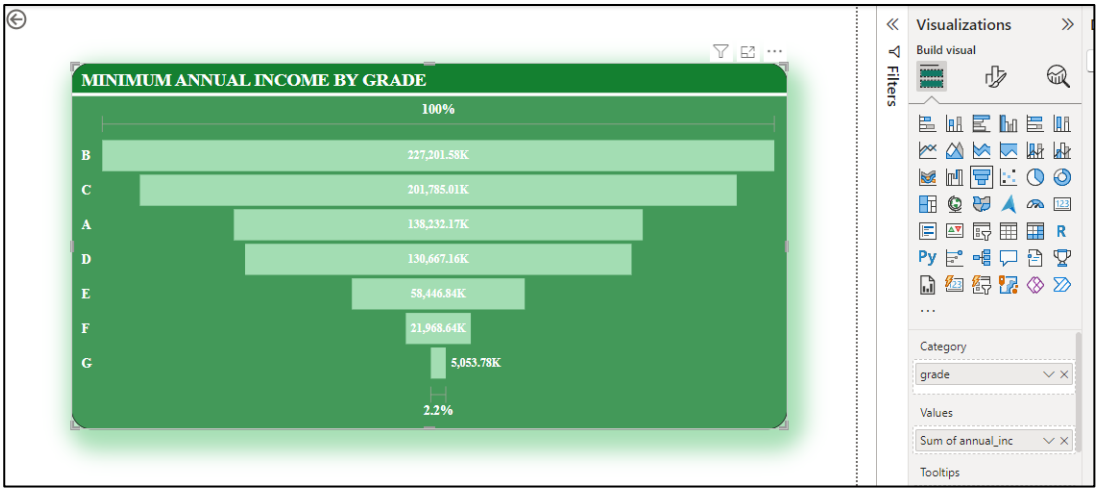
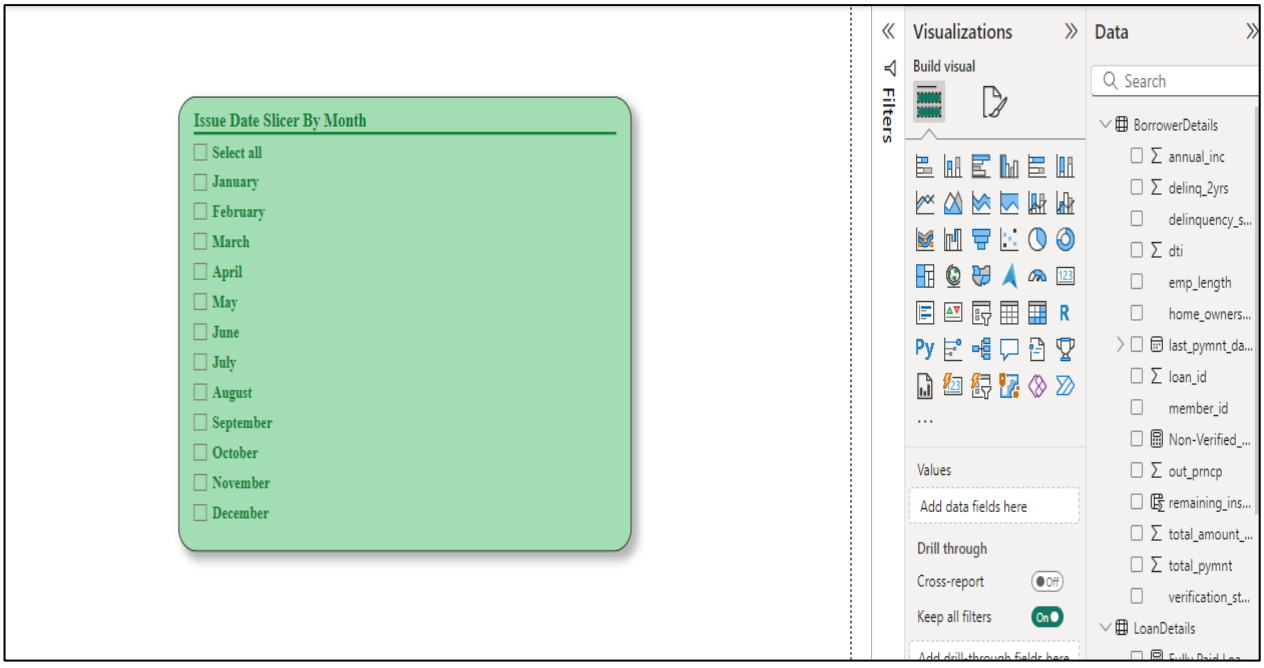
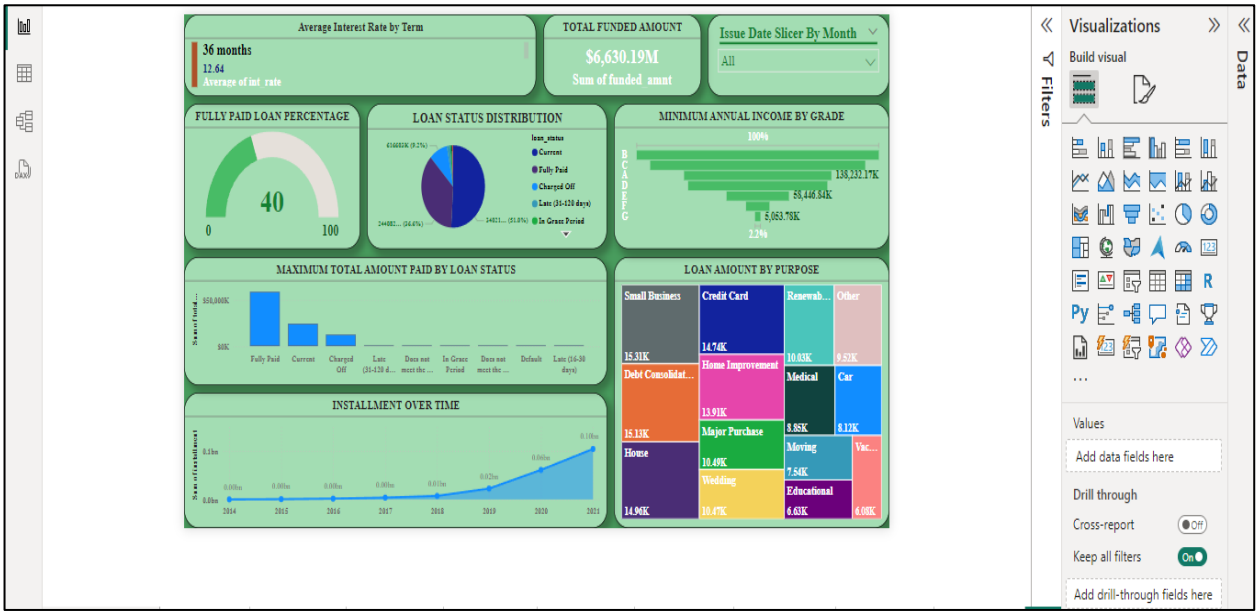


Figure 5.8

The funnel chart shows that borrowers with mostly grade B have the lowest average annual income, followed by those with second most grade C. As the grades increase from A to G, the average annual income generally rises.

9. **Issue Date Slicer:** Add a slicer for the Month of the issue date to enable dynamic data exploration.





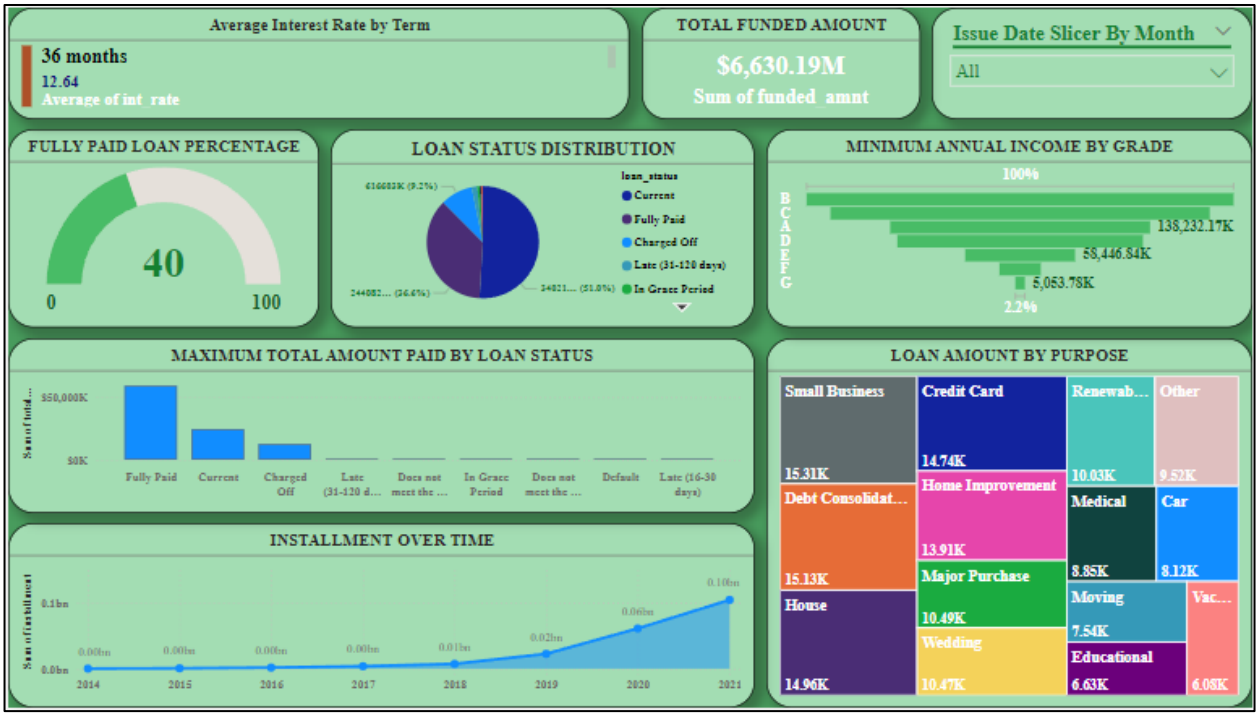


Figure 5.9

Key finding:

- **January:** The percentage of fully paid loans was significantly higher in January compared to other months.
- **March and June:** Home loans accounted for the majority of loan amounts in both March and June.
- **April:** The total amount paid by current and fully paid loans was relatively equal in April.
- **July:** Grace period loans constituted the largest portion of total payments in July.
- **September and December 2021:** The total installments paid in September and December 2021 were lower than in the previous year.
- **October:** The total funded amount was exceptionally high in October compared to other months.
- **November:** The percentage of fully paid loans in November was notably lower than in other months.

The chart illustrates the 'Fully Paid Loan Percentage,' which stands at 40%. The reveals that small business loans have the highest average loan amounts, followed by debt consolidation loans. Home loans, credit loans, and home improvement loans also hold significant average loan amounts. Other loan purposes, such as major purchases, weddings, renewable energy, other expenses, medical expenses, moving costs, educational expenses, car purchases, and vacations, generally have lower average loan amounts. The pie chart shows the distribution of total payments by loan status. The majority of borrowers (51%) have current loans, followed by those who have fully paid their loans (36.6%). A smaller percentage of borrowers have charged-off loans (9.2%). The remaining borrowers are categorized as late (31-120 days), in grace period, late (16-30 days), do not meet the credit policy and are in default (3.2%).

6) Report 2: Borrower Profile Analysis:

The Borrower Profile Analysis report aims to provide insights into the characteristics of borrowers such as home ownership, annual income, employment length, verification status, debt-to-income ratio, and delinquency history.

1. **KPI Visual:** Create a KPI visual with the sum of total payment as the value, the year of last payment date as the trend axis, and the sum of loan amount as the target. Round off to 2 decimal points and format as $ currency.

Figure 6.1

- **Performance Against Target:** When the total payments approach or surpass $875.60M, it reflects robust repayment performance. Conversely, a significantly lower amount may indicate challenges in loan recovery.
- **Yearly Trends**: Analyzing years with varying payment levels can provide insights into external factors influencing repayment behaviors.
- **Achievement of Goal:** Setting a goal of $25.91M, representing a 3279.87% increase, establishes a high standard. Meeting this goal would signify outstanding performance and substantial growth in repayments.

2. **Average of Annual Income:** Display the average of annual income using a card visual.

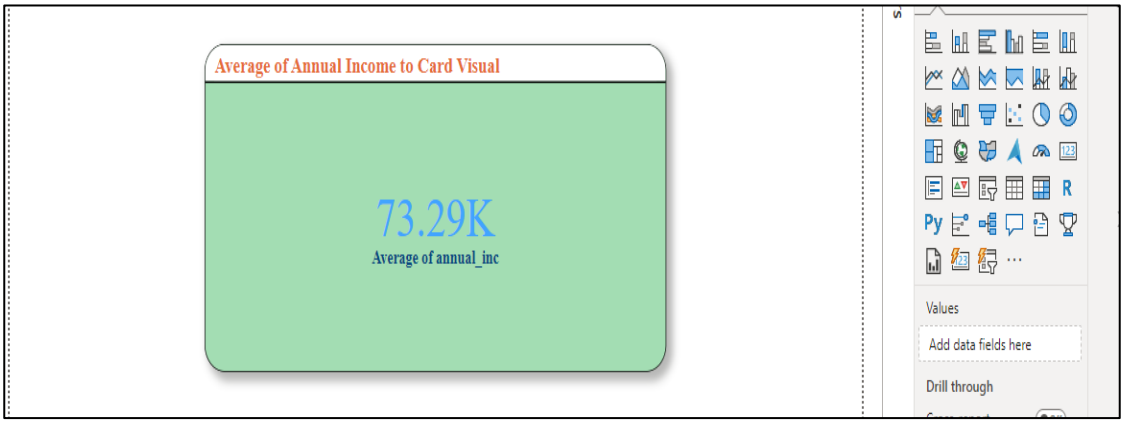


Figure 6.2

An average annual income of 73.29K provides a clear indicator of the financial status of the group being analyzed.

3. **Non-Verified Borrowers Count**: Display the count of non-verified borrowers using a card visual.

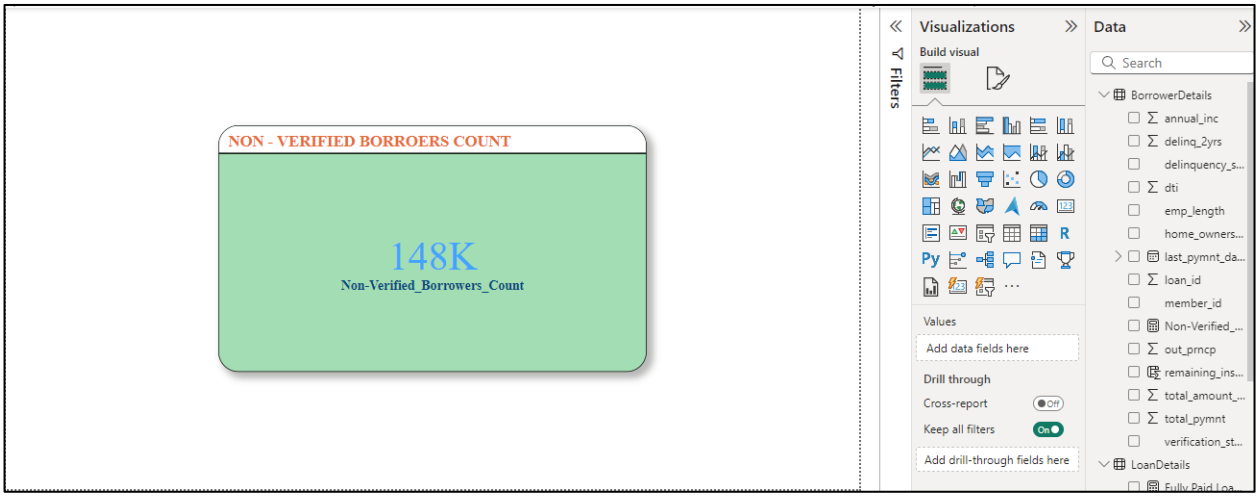


Figure 6.3

Having 148,000 non-verified borrowers represents a substantial part of the borrower base without verification, which could pose a significant risk for loan defaults.

4. **Average Debt-to-Income by Delinquency Status**: Create a multi-row card to show the average debt-to-income ratio by delinquency status.

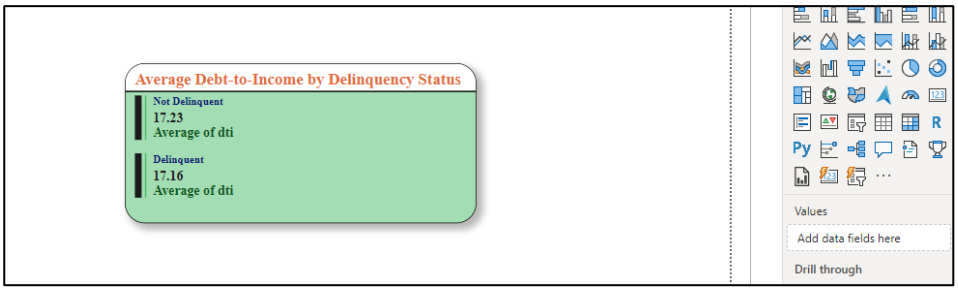
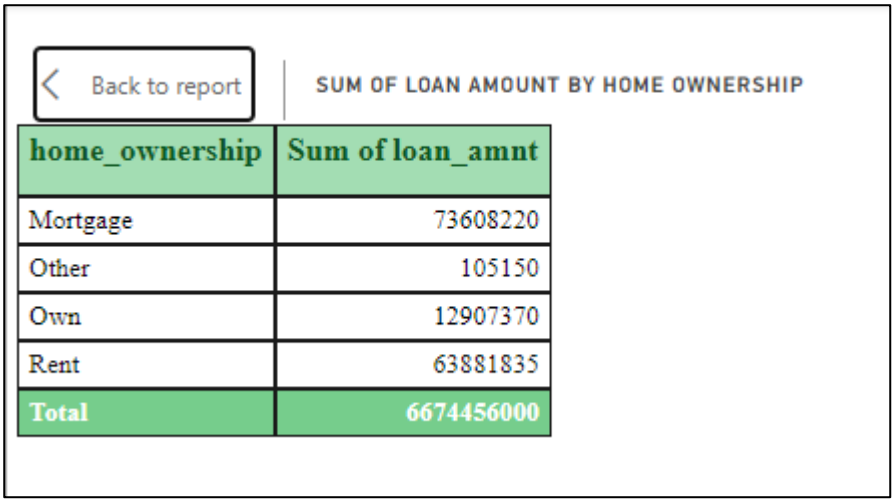


Figure 6.4

This setup makes it easy to see the average debt-to-income ratios for borrowers with delinquency status 17.16 and those without delinquency status 17.23.

5. **Sum of Loan Amount by Home Ownership**: Create a table to show the total loan amount by home ownership.



home_ownership	Sum of loan_amnt
Mortgage	73608220
Other	105150
Own	12907370
Rent	63881835
Total	**6674456000**

Figure 6.5

The above table shows that the majority of the loan amounts are associated with mortgages and renting, with significantly smaller amounts for other types of home ownership.

6. **Average Remaining Principal by Verification Status**: Create a donut chart to display the average remaining outstanding principal by verification status.

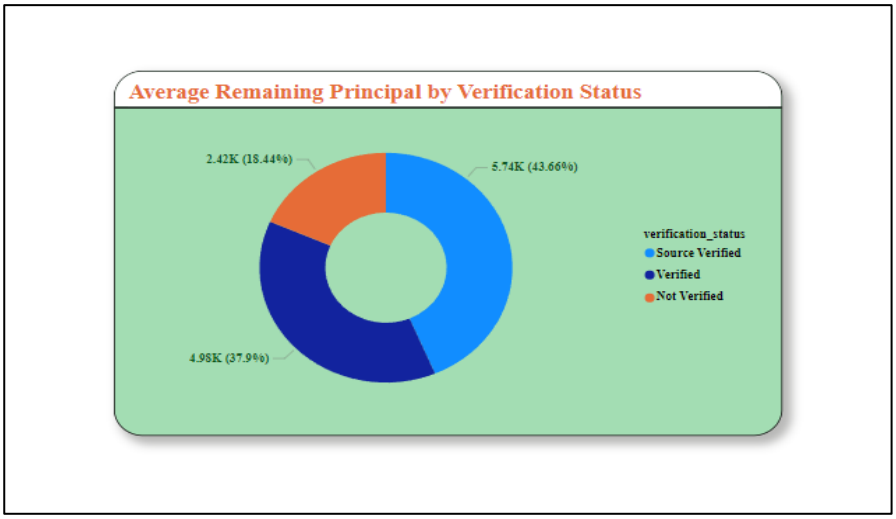


Figure 6.6

The donut chart illustrates the average remaining principal by verification status, showing that the majority is **source verified (43.66%)**, followed by **verified (37.9%)**, and then **not verified (18.44%)**.

7. **Sum of Delinquencies by Home Ownership**: Create a bar chart to show the total number of delinquencies in the past 2 years by home ownership and filter the visual to display only Mortgage, Rent, and Own.

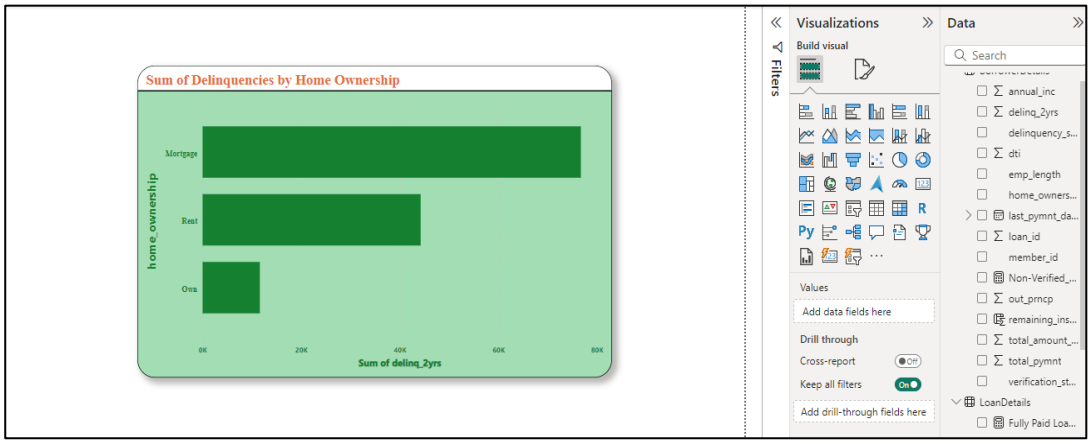


Figure 6.7

The bar chart above illustrates the sum of delinquencies by home ownership status. It shows that the majority of delinquencies are associated with mortgage holders, followed by those who rent, and the lowest number of delinquencies is among those who own their homes outright.

8. **Max Remaining Installments by Employment Length**: Create a treemap to show the maximum remaining installments by employment length.

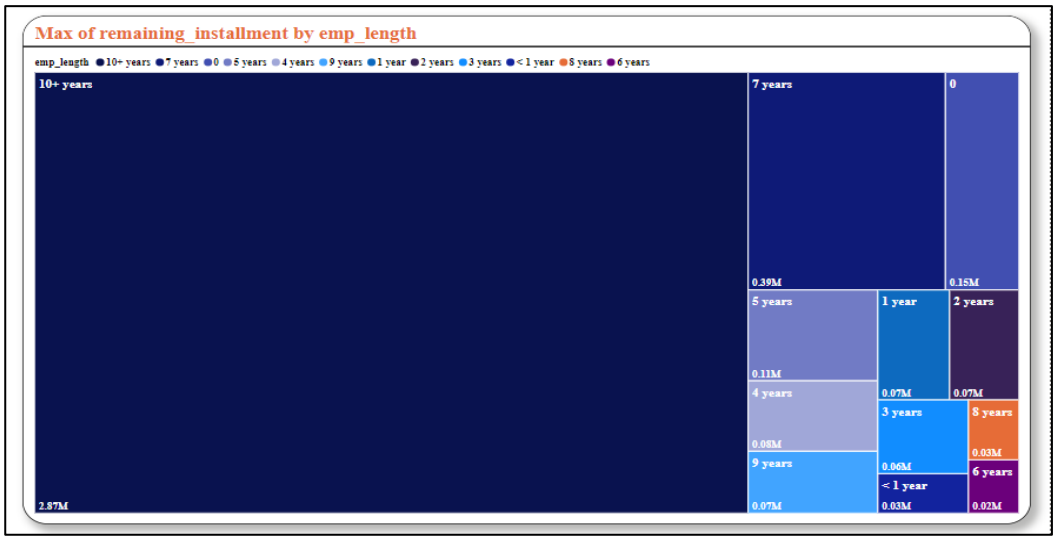


Figure 6.8

The treemap above illustrates the maximum remaining installment by employment length, with the majority being for those with **10+ years of employment**, followed by those with **less than 10 years**.

9. **Total Amount Paid and Funded Amount Over Time**: Create a line chart to display the sum of total amount paid and the sum of funded amount by the year of last payment date.

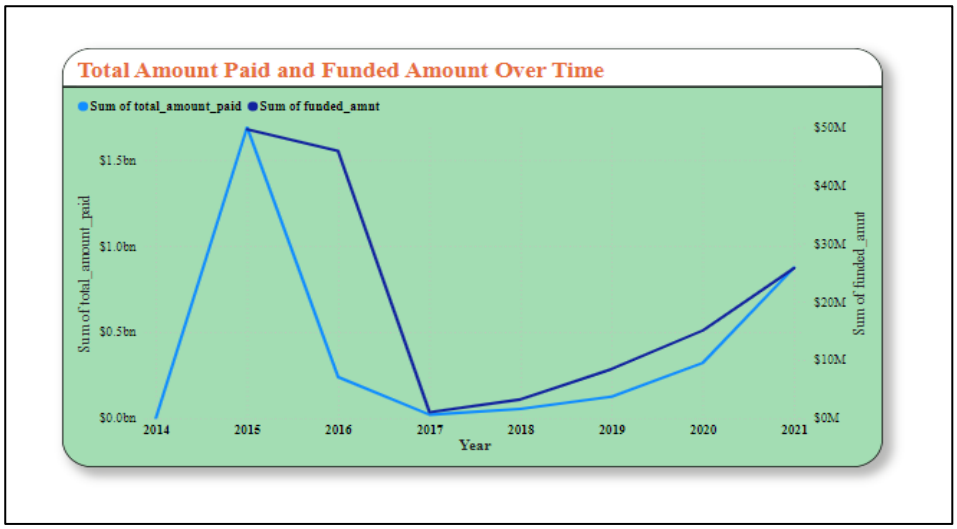
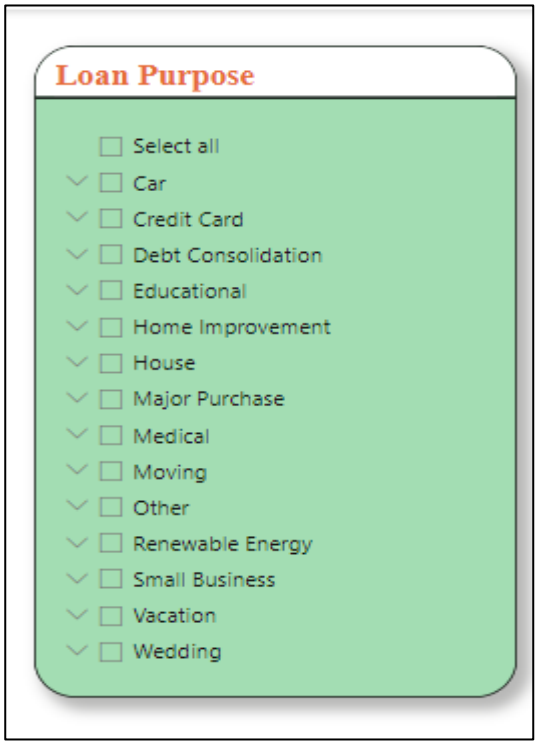
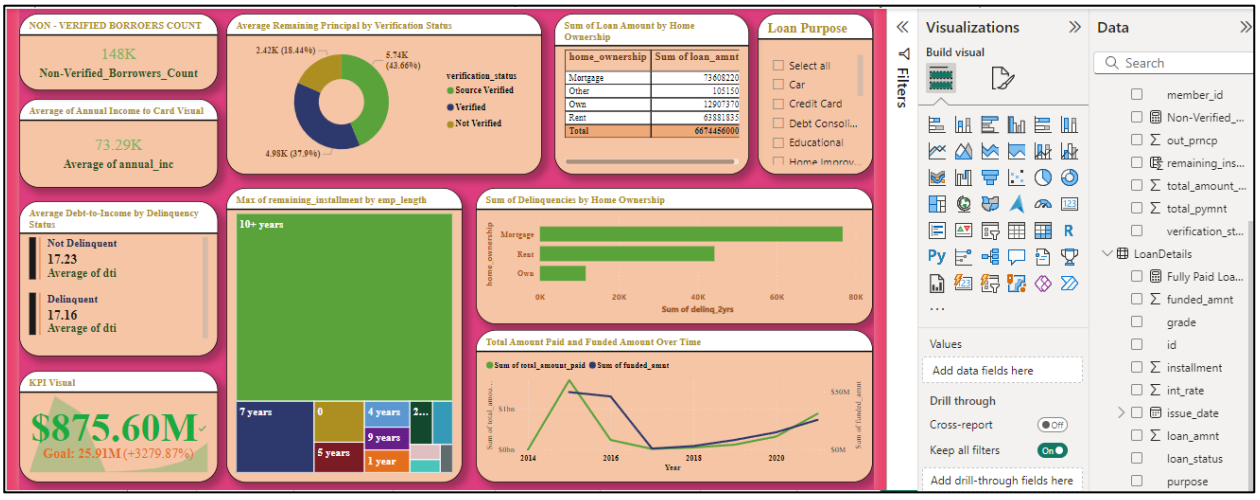


Figure 6.9

The line chart above indicates that both the sum of the total amount paid and the sum of the funded amount experienced an uncertain decrease in 2017. However, in the following years, there was a rapid increase in both metrics, highlighting a significant upward trend.

10. **Purpose Slicer**: Add a slicer for loan purpose to enable dynamic data exploration.





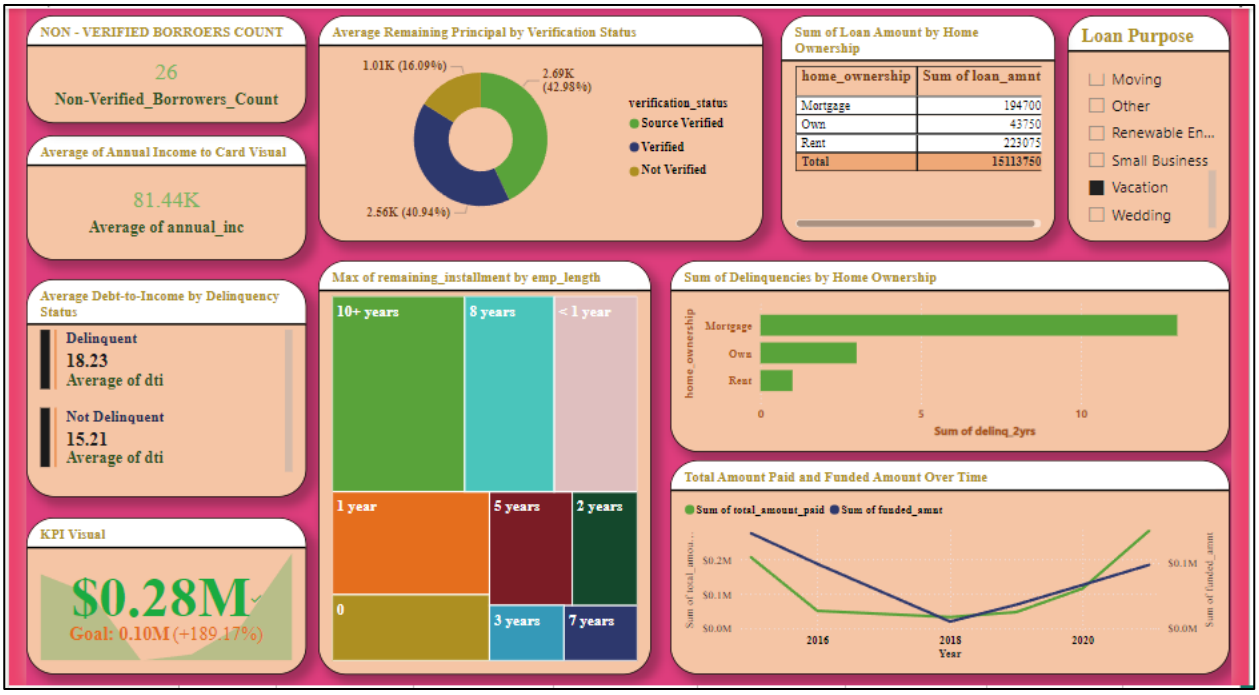


Figure 6.10

Key finding:

- **Car Loans:** The average annual income for individuals with car loans is $77.32K.
- **Credit Card:** The KPI visual shows a loss of 6.4% compared to the target value.
- **Credit Consolidation:** The count of non-verified borrowers is 1,981, which is higher compared to other categories.
- **House Loans:** The KPI visual is 31.62% below the target value.
- **Moving Loans:** The percentage of source-verified loans for moving purposes is very high at 72.05%.
- **Small Business Ownership:** The majority of remaining installments by employee length is for 5 years.
- **Wedding Loans:** The maximum remaining installment by employee length is greater than 1 year.

Performance Against Target: When the total payments approach or surpass $875.60M, it reflects robust repayment performance. Conversely, a significantly lower amount may indicate challenges in loan recovery. **Yearly Trends**: Analyzing years with varying payment levels can provide insights into external factors influencing repayment behaviors. **Achievement of Goal:** Setting a goal of $25.91M, representing a 3279.87% increase, establishes a high standard. Meeting this goal would signify outstanding performance and substantial growth in repayments.

The line chart above indicates that both the sum of the total amount paid and the sum of the funded amount experienced an uncertain decrease in 2017. However, in the following years, there was a rapid increase in both metrics, highlighting a significant upward trend.

CHAPTER – V

INTERPRETATION:

Loan Performance Analysis:

In January, the percentage of fully paid loans was much higher than in other months. Home loans made up the majority of loan amounts in March and June. In April, the total amount paid by current and fully paid loans was almost equal. July saw the largest portion of total payments coming from grace period loans. The total installments paid in September and December 2021 were lower than the previous year. October had an exceptionally high total funded amount, while November had a notably lower percentage of fully paid loans.

In January, the percentage of fully paid loans was much higher than in other months. Home loans made up the majority of loan amounts in March and June. In April, the total amount paid by current and fully paid loans was almost equal. July saw the largest portion of total payments coming from grace period loans. The total installments paid in September and December 2021 were lower than the previous year. October had an exceptionally high total funded amount, while November had a notably lower percentage of fully paid loans. To improve performance, replicate successful strategies from January, focus on home loans in March and June, balance payments in April, review grace period terms in July, investigate declines in September and December, prepare for high demand in October, and offer support in November.

Borrower Profile Analysis:

For specific loan purposes, car loan borrowers have an average annual income of $77.32K. Credit card KPIs show a 6.4% loss compared to the target. Credit consolidation has 1,981 non-verified borrowers, higher than other categories. House loan KPIs are 31.62% below the target. Moving loans have a high verification rate at 72.05%. Small business loans mostly have remaining installments for employees with a length of 5 years, and wedding loans have a maximum remaining installment period of over 1 year.

To improve loan performance, focus on addressing the 6.4% loss in credit card KPIs by identifying and mitigating key risk factors. Enhance verification processes for credit consolidation loans, as they have the highest number of non-verified borrowers (1,981). Prioritize strategies to boost house loan KPIs, which are significantly below target by 31.62%. Leverage the high verification rate of moving loans (72.05%) as a best practice model for other loan categories. For small business loans, consider offering flexible installment plans to accommodate the typical 5-year employee installment length. Lastly, ensure wedding loans have manageable repayment terms, given their maximum remaining installment period of over 1 year.