Analyzing Churn Patterns Among Bank Customers

CIS - 5550

Submitted to: Prof. Taimoor Khan

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Introduction

What is Churn Analysis?

Churn analysis is the evaluation of a company's customer loss rate in order to reduce it. Churn analysis helps you identify pain points throughout the entire customer journey.

Why is churn Analysis important in Banking?

Churn analysis stands out as a cornerstone in the banking sector, providing an invaluable perspective that empowers institutions to comprehend and respond effectively to the dynamic nature of customer behavior. Through a meticulous examination of the client's customer database, the analysis unveils profound insights into the nuanced needs and preferences of the customer base. These insights, in turn, become the foundation for crafting a targeted customer retention plan aimed at mitigating churn. The strategic alignment of the bank's products with identified customer needs goes beyond mere gap bridging; it catalyzes a transformative impact on customer satisfaction levels. This positive shift initiates a virtuous cycle where heightened satisfaction leads to an organic increase in customer loyalty. The symbiotic relationship between churn analysis and customer retention strategies manifests in compelling success metrics, evident in a substantial annual return on investment reaching an impressive 60%.

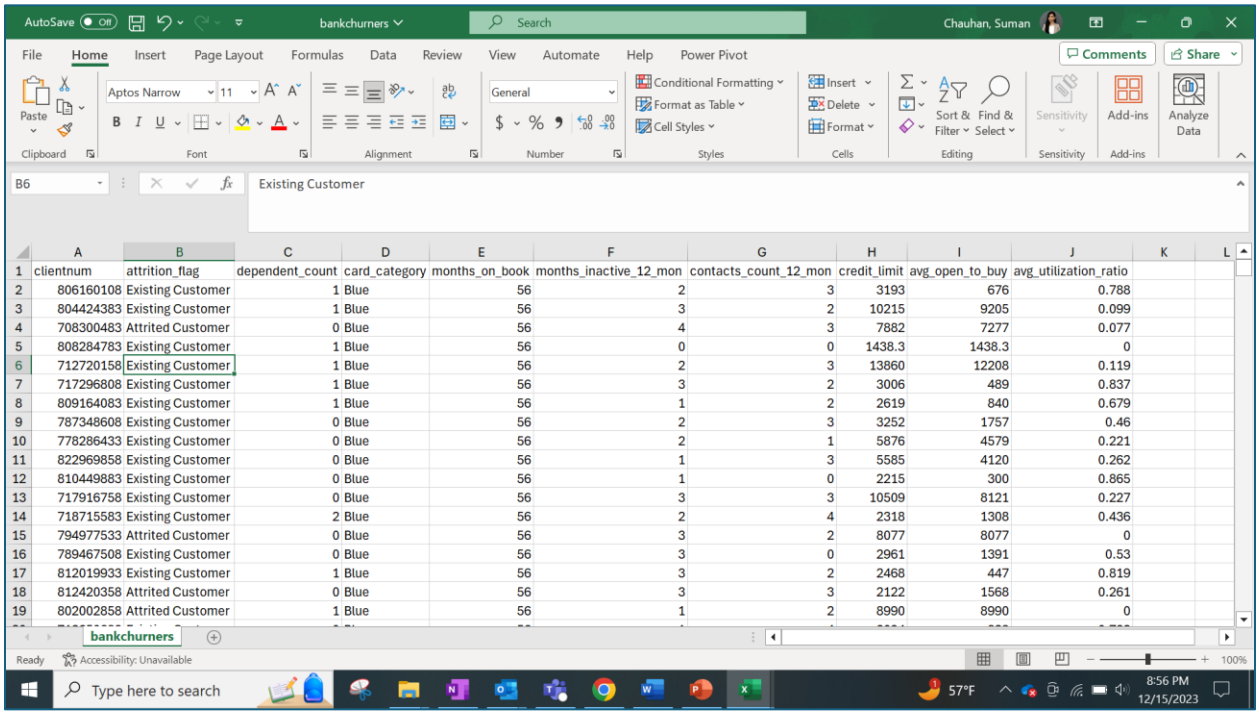
Within this paradigm, the influence of churn analysis extends far beyond simple data interpretation, serving as a catalyst for the bank's transformative journey towards customer-centricity. The capability to discern and address customer needs directly informs the development of a robust marketing plan, strategically tailored to resonate with the clientele. This integrated approach to understanding customer behavior not only fortifies customer loyalty but also establishes the groundwork for sustained financial success. The interwoven elements of churn analysis, customer retention initiatives, and targeted marketing converge to weave a powerful tapestry. This not only shields the bank from customer attrition but propels it towards a future characterized by enduring customer relationships and sustained profitability, securing its position as a dynamic and customer-centric financial institution.

Dataset and Data Description

The dataset comprised of three files, namely, BankChurners.csv, basic_client_info.csv, enriched_churn_data.csv

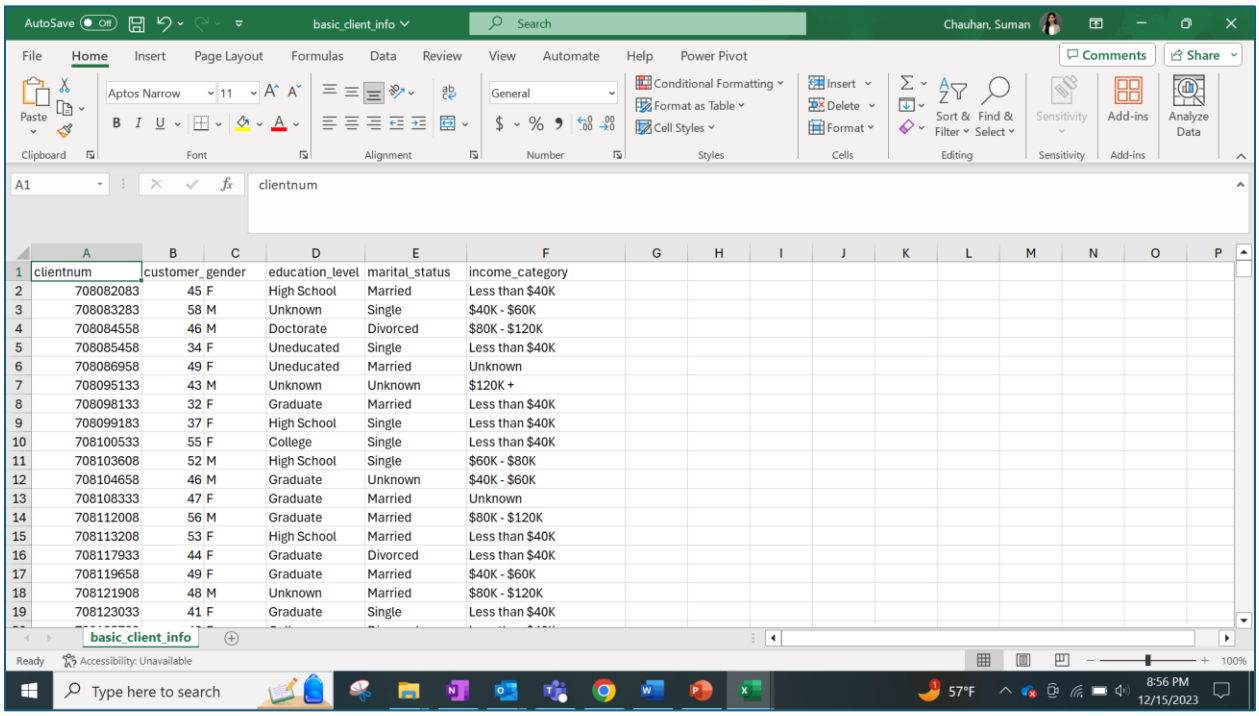
- ***BankChurners.csv*** – this file contains basic information about each client (10 columns), E.g., value: credit limit.
- ***basic_client_info.csv*** - this file contains basic client info per client (6 columns), E.g., value: customer age.
- ***enriched_churn_data.csv*** - this file contains enriched data about each client (7 columns), E.g., value: total revolving balance.

BankChurners.csv



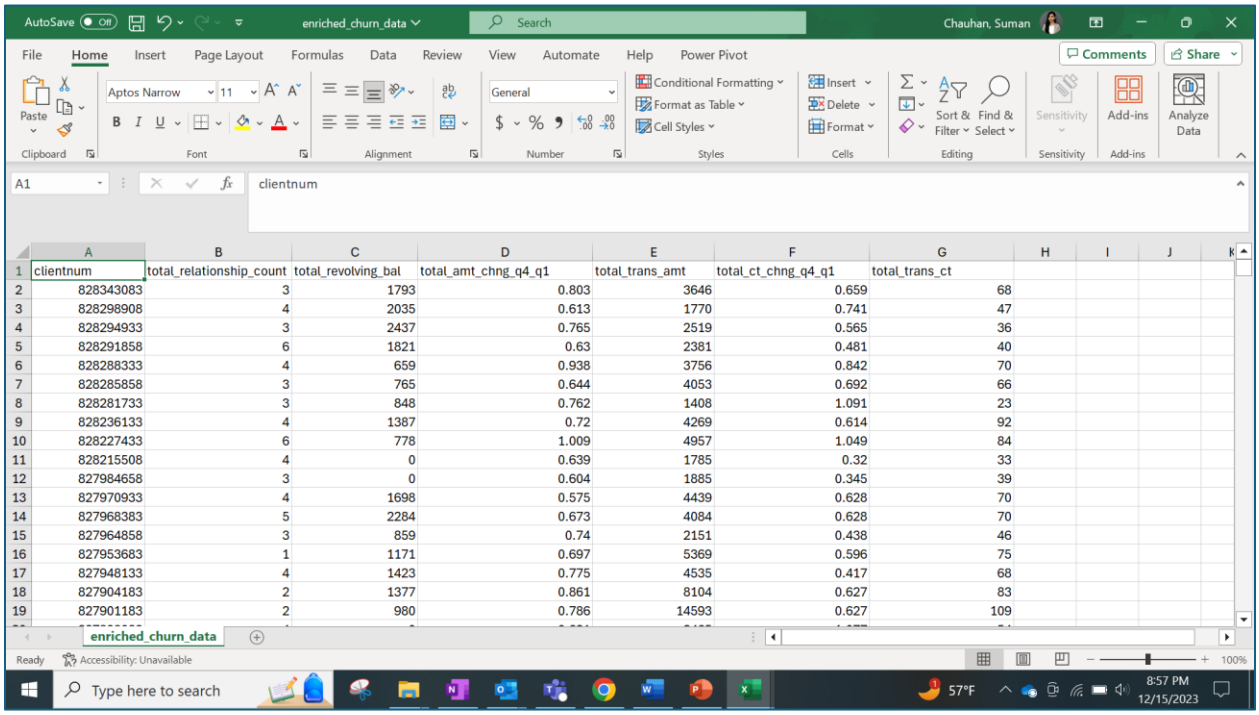
	A	B	C	D	E	F	G	H	I	J	K	L
1	clientnum	attrition_flag	dependent_count	card_category	months_on_book	months_inactive_12_mon	contacts_count_12_mon	credit_limit	avg_open_to_buy	avg_utilization_ratio		
2	806160108	Existing Customer	1	Blue	56	2	3	3193	676	0.788		
3	804424383	Existing Customer	1	Blue	56	3	2	10215	9205	0.099		
4	708300483	Attrited Customer	0	Blue	56	4	3	7882	7277	0.077		
5	808284783	Existing Customer	1	Blue	56	0	0	1438.3	1438.3	0		
6	712720158	Existing Customer	1	Blue	56	2	3	13860	12208	0.119		
7	717296808	Existing Customer	1	Blue	56	3	2	3006	489	0.837		
8	809164083	Existing Customer	1	Blue	56	1	2	2619	840	0.679		
9	787348608	Existing Customer	0	Blue	56	2	3	3252	1757	0.46		
10	778286433	Existing Customer	0	Blue	56	2	1	5876	4579	0.221		
11	822969858	Existing Customer	0	Blue	56	1	3	5585	4120	0.262		
12	810449883	Existing Customer	0	Blue	56	1	0	2215	300	0.865		
13	717916758	Existing Customer	0	Blue	56	3	3	10509	8121	0.227		
14	718715583	Existing Customer	2	Blue	56	2	4	2318	1308	0.436		
15	794977533	Attrited Customer	0	Blue	56	3	2	8077	8077	0		
16	789467508	Existing Customer	0	Blue	56	3	0	2961	1391	0.53		
17	812019933	Existing Customer	1	Blue	56	3	2	2468	447	0.819		
18	812420358	Attrited Customer	0	Blue	56	3	3	2122	1568	0.261		
19	802002858	Attrited Customer	1	Blue	56	1	2	8990	8990	0		

basic_client_info.csv



clientnum	customer_	gender	education_level	marital_status	income_category
708082083	45	F	High School	Married	Less than $40K
708083283	58	M	Unknown	Single	$40K - $60K
708084558	46	M	Doctorate	Divorced	$80K - $120K
708085458	34	F	Uneducated	Single	Less than $40K
708086958	49	F	Uneducated	Married	Unknown
708095133	43	M	Unknown	Unknown	$120K +
708098133	32	F	Graduate	Married	Less than $40K
708099183	37	F	High School	Single	Less than $40K
708100533	55	F	College	Single	Less than $40K
708103608	52	M	High School	Single	$60K - $80K
708104658	46	M	Graduate	Unknown	$40K - $60K
708108333	47	F	Graduate	Married	Unknown
708112008	56	M	Graduate	Married	$80K - $120K
708113208	53	F	High School	Married	Less than $40K
708117933	44	F	Graduate	Divorced	Less than $40K
708119658	49	F	Graduate	Married	$40K - $60K
708121908	48	M	Unknown	Married	$80K - $120K
708123033	41	F	Graduate	Single	Less than $40K

enriched_churn_data.csv



clientnum	total_relationship_count	total_revolving_bal	total_amt_chng_q4_q1	total_trans_amt	total_ct_chng_q4_q1	total_trans_ct
828343083	3	1793	0.803	3646	0.659	68
828298908	4	2035	0.613	1770	0.741	47
828294933	3	2437	0.765	2519	0.565	36
828291858	6	1821	0.63	2381	0.481	40
828288333	4	659	0.938	3756	0.842	70
828285858	3	765	0.644	4053	0.692	66
828281733	3	848	0.762	1408	1.091	23
828236133	4	1387	0.72	4269	0.614	92
828227433	6	778	1.009	4957	1.049	84
828215508	4	0	0.639	1785	0.32	33
827984658	3	0	0.604	1885	0.345	39
827970933	4	1698	0.575	4439	0.628	70
827968383	5	2284	0.673	4084	0.628	70
827964858	3	859	0.74	2151	0.438	46
827953683	1	1171	0.697	5369	0.596	75
827948133	4	1423	0.775	4535	0.417	68
827904183	2	1377	0.861	8104	0.627	83
827901183	2	980	0.786	14593	0.627	109

Dataset

Please find the above mentioned 3 csv files attached below.

bankchurners.csv basic_client_info.csv enriched_churn_data.csv

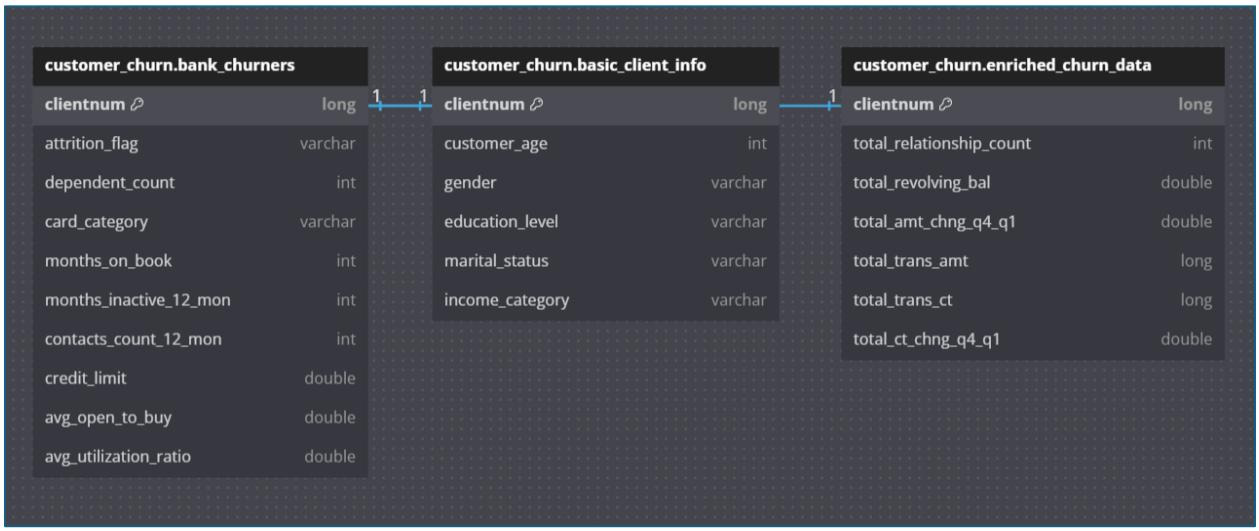
Summary Statistics

	clientnum	dependent_count	months_on_book	months_inactive_12_mon	contacts_count_12_mon	credit_limit	avg_open_to_buy	avg_utilization_ratio
count	1.012700e+04	10127.000000	10127.000000	10127.000000	10127.000000	10127.000000	10127.000000	10127.000000
mean	7.391776e+08	2.346203	35.928409	2.341167	2.455317	8631.953698	7469.139637	0.274894
std	3.690378e+07	1.298908	7.986416	1.010622	1.106225	9088.776650	9090.685324	0.275691
min	7.080821e+08	0.000000	13.000000	0.000000	0.000000	1438.300000	3.000000	0.000000
25%	7.130368e+08	1.000000	31.000000	2.000000	2.000000	2555.000000	1324.500000	0.023000
50%	7.179264e+08	2.000000	36.000000	2.000000	2.000000	4549.000000	3474.000000	0.176000
75%	7.731435e+08	3.000000	40.000000	3.000000	3.000000	11067.500000	9859.000000	0.503000
max	8.283431e+08	5.000000	56.000000	6.000000	6.000000	34516.000000	34516.000000	0.999000

	clientnum	total_relationship_count	total_revolving_bal	total_amt_chng_q4_q1	total_trans_amt	total_ct_chng_q4_q1	total_trans_ct
count	1.012700e+04	10127.000000	10127.000000	10127.000000	10127.000000	10127.000000	10127.000000
mean	7.391776e+08	3.812580	1162.814061	0.759941	4404.086304	0.712222	64.858695
std	3.690378e+07	1.554408	814.987335	0.219207	3397.129254	0.238086	23.472570
min	7.080821e+08	1.000000	0.000000	0.000000	510.000000	0.000000	10.000000
25%	7.130368e+08	3.000000	359.000000	0.631000	2155.500000	0.582000	45.000000
50%	7.179264e+08	4.000000	1276.000000	0.736000	3899.000000	0.702000	67.000000
75%	7.731435e+08	5.000000	1784.000000	0.859000	4741.000000	0.818000	81.000000
max	8.283431e+08	6.000000	2517.000000	3.397000	18484.000000	3.714000	139.000000

	clientnum	customer_age
count	1.012700e+04	10127.000000
mean	7.391776e+08	46.325960
std	3.690378e+07	8.016814
min	7.080821e+08	26.000000
25%	7.130368e+08	41.000000
50%	7.179264e+08	46.000000
75%	7.731435e+08	52.000000
max	8.283431e+08	73.000000

Entity Relationship Diagram



Why did we choose this dataset for our project? (data relevance)

The selection of the dataset for our analysis was a strategic decision driven by its versatility across multiple analytical platforms. This dataset uniquely provided us with the opportunity to harness the power of SQL, Python, and Tableau for a comprehensive analysis. The integration of these three tools allowed us to exploit their respective strengths, facilitating a more holistic exploration of the data.

One notable feature of the chosen dataset is its organization into three distinct files, enabling us to leverage the JOIN function in SQL effectively. This capability allowed us to merge and combine disparate pieces of information, enhancing our ability to derive meaningful correlations and patterns from the data. Moreover, the dataset boasts a rich array of dimensions and measures, providing us with a robust foundation for generating compelling visuals and extracting valuable insights. The abundance of data points within the dataset not only facilitated a thorough examination of trends but also empowered us to create informative and visually appealing representations using Tableau, thereby enhancing the overall depth and breadth of our analysis.

Questions of Analysis:

SQL Analysis

- How many clients does the bank have and are above the age of 50?
- What is the distribution (in %) between male and female clients?
- Which client has the 2nd highest Total_Trans_Amt, Per each Marital_Status.

Correlation Analysis

- By cross-examining columns against each other, more insights and broader questions can be asked and answered, and it could be assessed how variables are correlated to each other.

Python Analysis

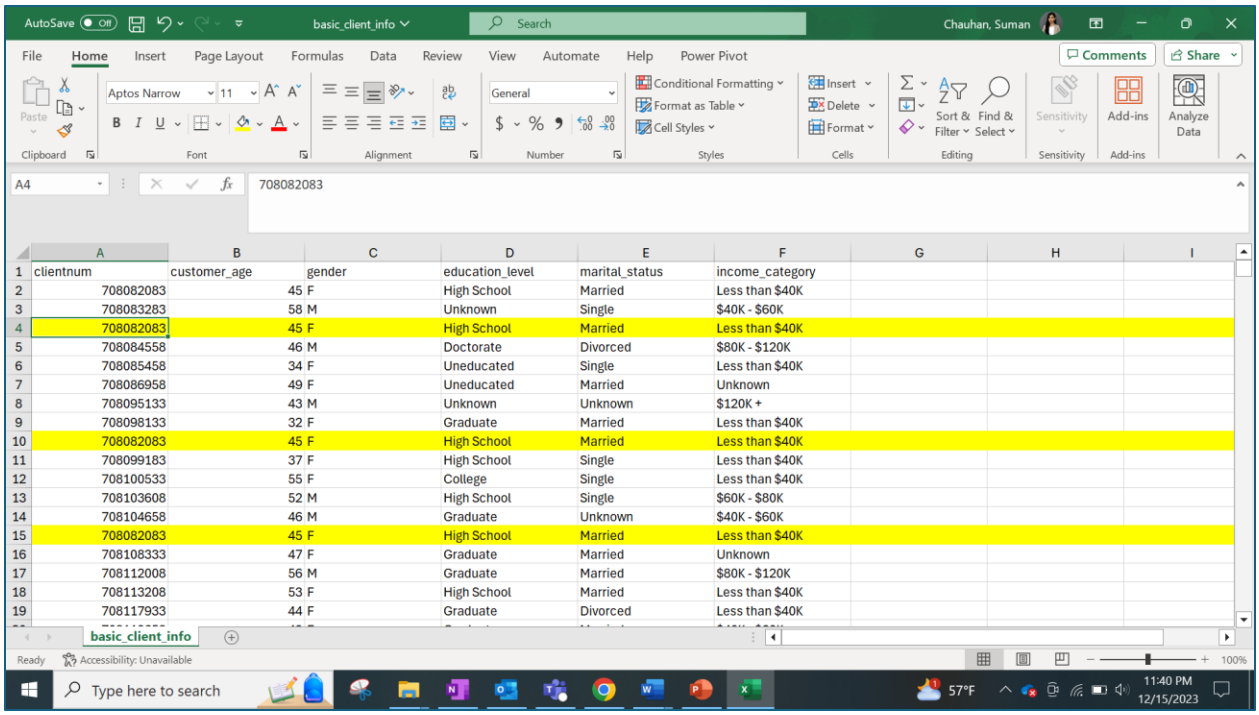
- What type of credit card holders have churned the most? How about Customer Retention?
- Is there a relationship between the credit card category, income category and the usage of credit cards by customers?

Tableau Dashboard

Data Cleaning

1. Removing duplicate values

Pre- Cleaning

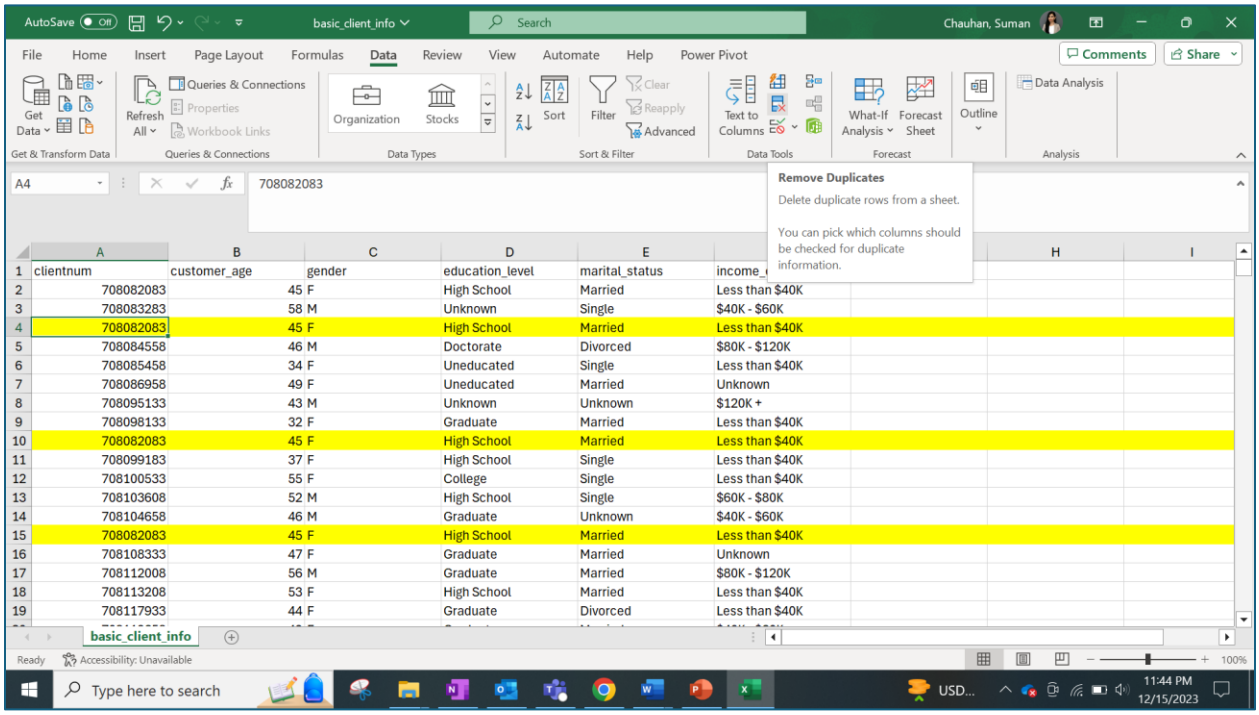


As seen in screenshot above, there are few duplicate rows in the dataset thus we decided to remove the duplicates from the data set using excel so that we get better visualizations and more accurate results. Thus, removing the duplicates was an essential step in our data cleaning process.

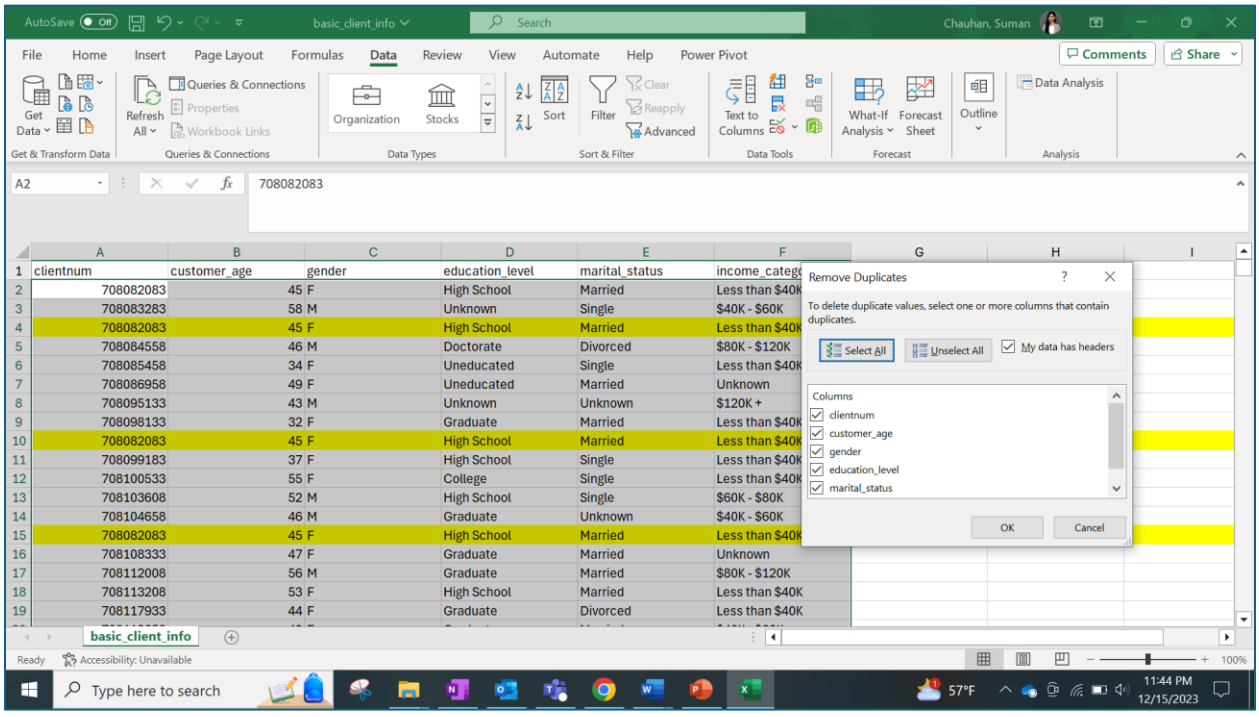
We used the ***Remove Duplicates*** feature in excel to remove the redundant rows.

To use the "Remove Duplicates" feature:

Step 1: Select the range of data.
Step 2: Go to the "Data" tab.
Step 3: Click on Remove Duplicates

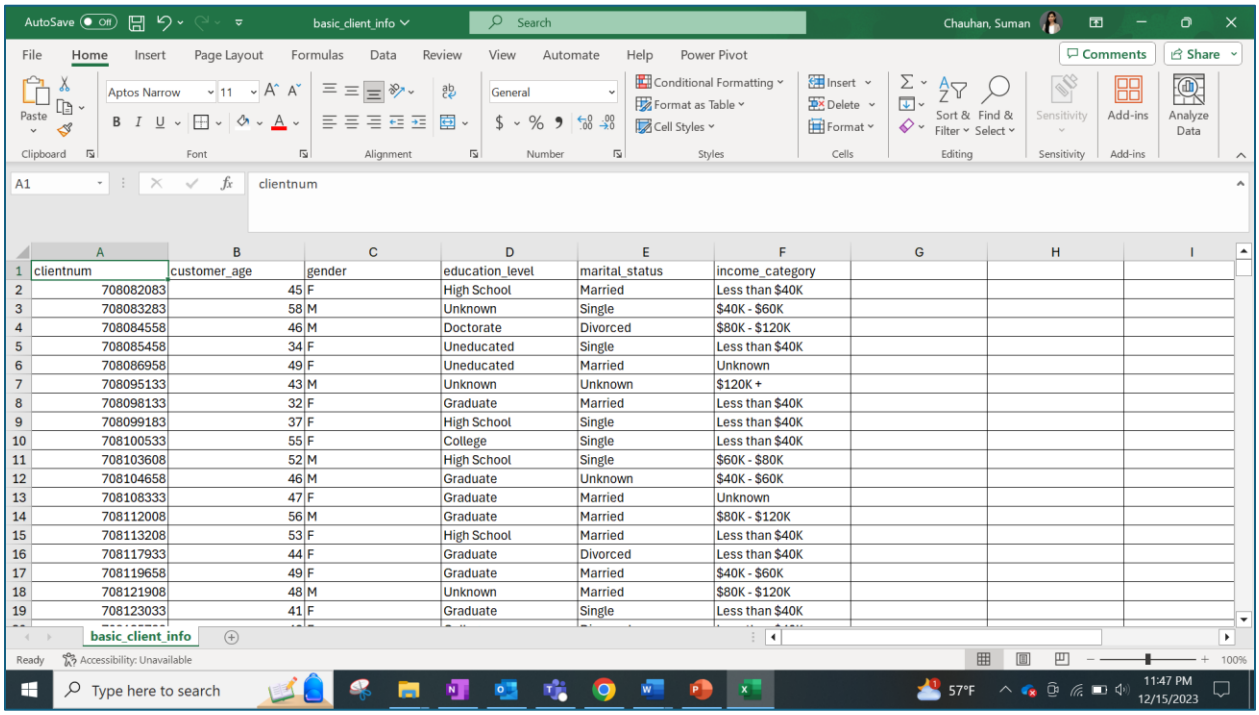


Step 4: Select All the columns where you want to find duplicates.



Step 5: Click "OK" to remove duplicates based on the selected columns.

Post Cleaning



clientnum	customer_age	gender	education_level	marital_status	income_category
708082083	45	F	High School	Married	Less than $40K
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708085458	34	F	Uneducated	Single	Less than $40K
708086958	49	F	Uneducated	Married	Unknown
708095133	43	M	Unknown	Unknown	$120K +
708098133	32	F	Graduate	Married	Less than $40K
708099183	37	F	High School	Single	Less than $40K
708100533	55	F	College	Single	Less than $40K
708103608	52	M	High School	Single	$60K - $80K
708104658	46	M	Graduate	Unknown	$40K - $60K
708108333	47	F	Graduate	Married	Unknown
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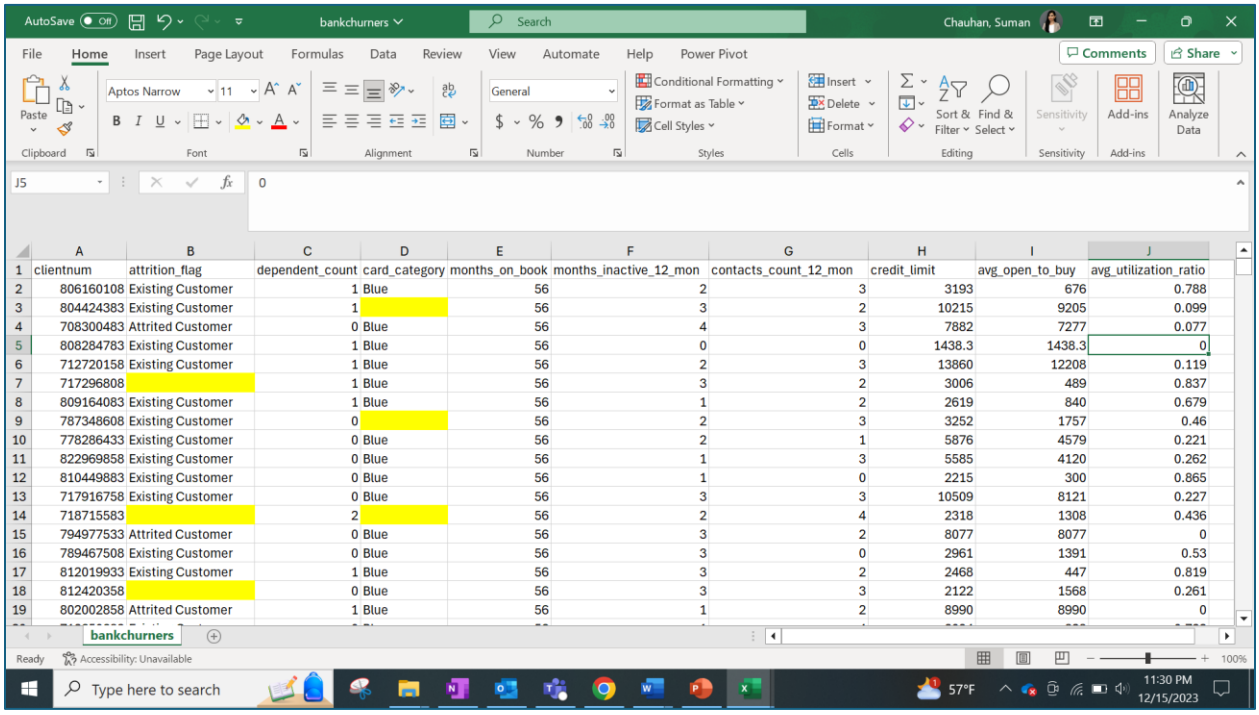
708117933	44	F	Graduate	Divorced	Less than $40K
708119658	49	F	Graduate	Married	$40K - $60K
708121908	48	M	Unknown	Married	$80K - $120K
708123033	41	F	Graduate	Single	Less than $40K

2. Removing Null values

Pre-Cleaning



clientnum	attrition_flag	dependent_count	card_category	months_on_book	months_inactive_12_mon	contacts_count_12_mon	credit_limit	avg_open_to_buy	avg_utilization_ratio
806160108	Existing Customer	1	Blue	56	2	3	3193	676	0.788
804424383	Existing Customer	1		56	3	2	10215	9205	0.099
708300483	Attrited Customer	0	Blue	56	4	3	7882	7277	0.077
808284783	Existing Customer	1	Blue	56	0	0	1438.3	1438.3	0
712720158	Existing Customer	1	Blue	56	2	3	13860	12208	0.119
717296808		1	Blue	56	3	2	3006	489	0.837
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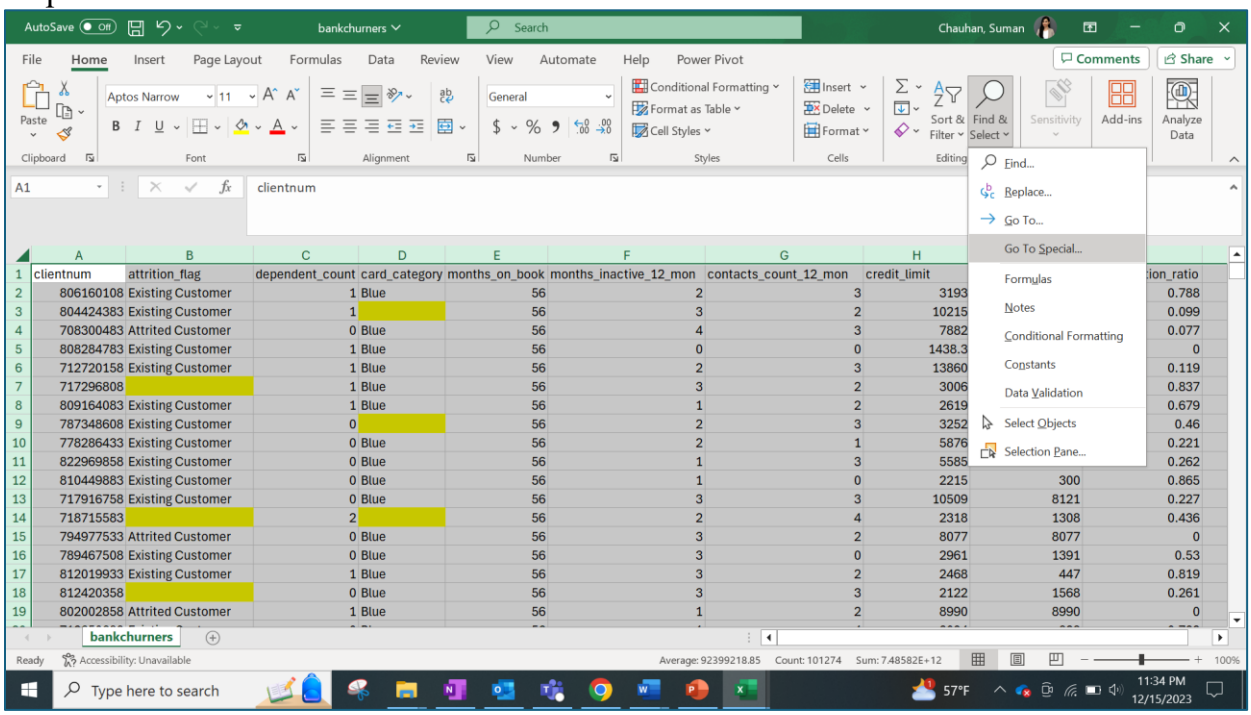
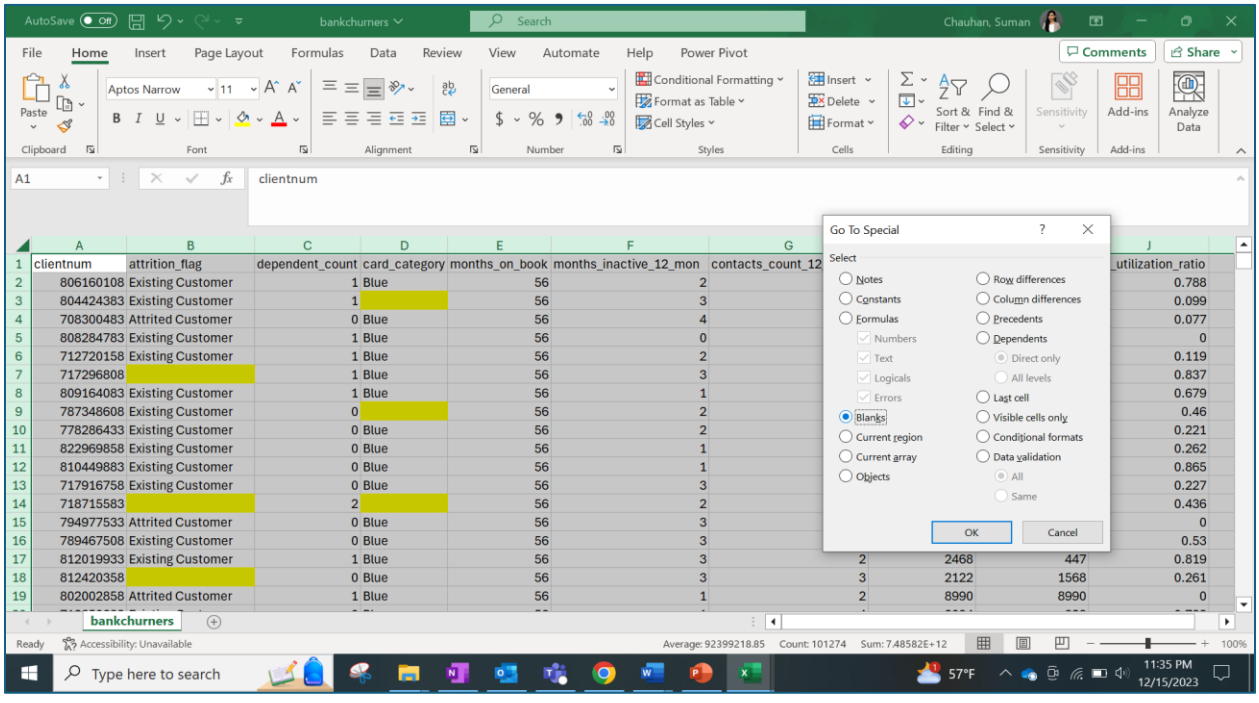
778286433	Existing Customer	0	Blue	56	2	1	5876	4579	0.221
822969858	Existing Customer	0	Blue	56	1	3	5585	4120	0.262
810449883	Existing Customer	0	Blue	56	1	0	2215	300	0.865
717916758	Existing Customer	0	Blue	56	3	3	10509	8121	0.227
718715583		2		56	2	4	2318	1308	0.436
794977533	Attrited Customer	0	Blue	56	3	2	8077	8077	0
789467508	Existing Customer	0	Blue	56	3	0	2961	1391	0.53
812019933	Existing Customer	1	Blue	56	3	2	2468	447	0.819
812420358		0	Blue	56	3	3	2122	1568	0.261
802002858	Attrited Customer	1	Blue	56	1	2	8990	8990	0

We used this data cleaning technique to remove Null values/blank spaces from our data set so that the result is accurate data which will give better visualization results.

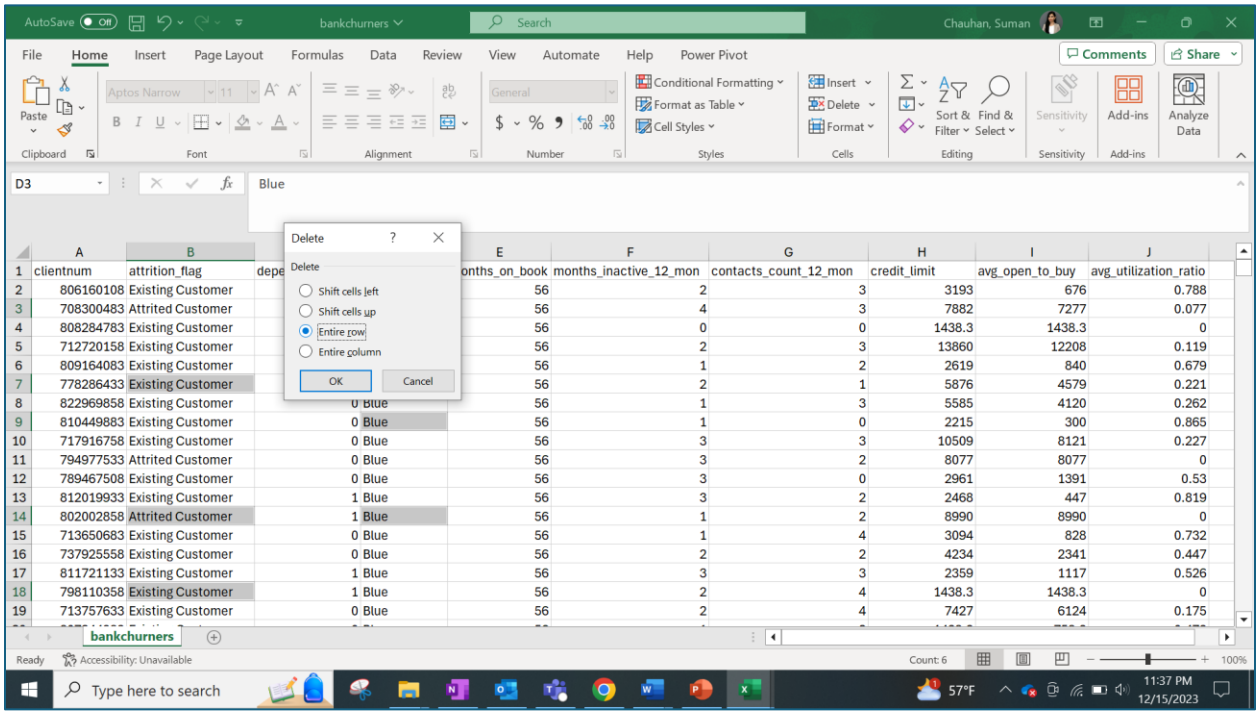
Step 1: Select all the column that contains Null values.
Step 2: Go to the Home Tab and click on Find & Select.



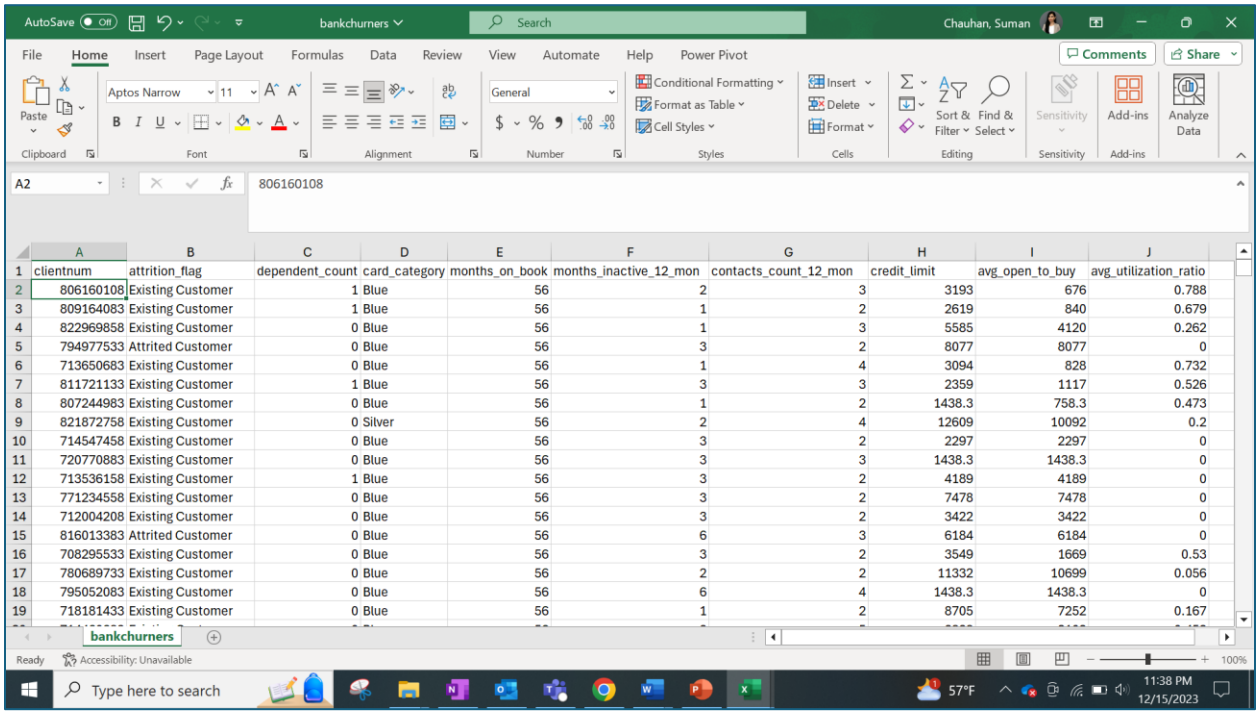
Step 3: Then click Go to Special, a new window will appear, Select Blanks and click on OK.



Step 4: The blank cells are highlighted, Right-click on any of the highlighted blank cells and select Delete Entire row.



Post Cleaning



SQL Analysis

1. **How many clients does the bank have and are above the age of 50?**

```
-- How many clients does the bank have and are above the age of 50?

SELECT COUNT(*) AS clients_above_50
FROM basic_client_info
WHERE customer_age > 50
;
```

	clients_above_50
0	3078

With the help of the above SQL query, we were able to answer the question and came up with the results that there were 3078 customers who were over the age of 50.

2. **What is the distribution (in %) between male and female clients?**

```
-- What's the distribution (in %) between male and female clients?
WITH total_count AS (
    SELECT
        COUNT(*) AS total
    FROM basic_client_info
    )
SELECT
  gender,
  ROUND(COUNT(*) * 100 / total :: numeric, 1) as percent_distribution
FROM basic_client_info, total_count
GROUP BY gender, total
;
```

	gender	percent_distribution
0	M	47.1
1	F	52.9

The SQL query above helped us accurately about the distribution of male and female clients. There are 47.1% of male clients and 52.9% of female clients.

3. Which client has the 2nd highest Total_Trans_Amt, Per each Marital_Status.

```
-- Which client (CLIENTNUM) has the 2nd highest Total_Trans_Amt, Per each Marital_Status.

WITH t1 AS (
    SELECT
        bci.clientnum,
        marital_status,
        total_trans_amt,
        DENSE_RANK() OVER (PARTITION BY marital_status ORDER BY total_trans_amt Desc) AS rnk
FROM basic_client_info AS bci
JOIN enriched_churn_data AS ecd
    ON bci.clientnum = ecd.clientnum
)
SELECT
    marital_status,
    clientnum AS client_with_2nd_highest_trans_amt
FROM t1
WHERE rnk=2
;
```

	marital_status	client_with_2nd_highest_trans_amt
0	Divorced	716894658
1	Married	717642633
2	Single	716004258
3	Unknown	719848008

As part of this project, we wanted to analyze the client that had 2nd highest Total_Trans_Amt by Matitial_Status. The screenshot above shows the results by marital status.

Correlation Analysis

Python Analysis

1. What type of credit card holders have churned the most? How about Customer Retention?

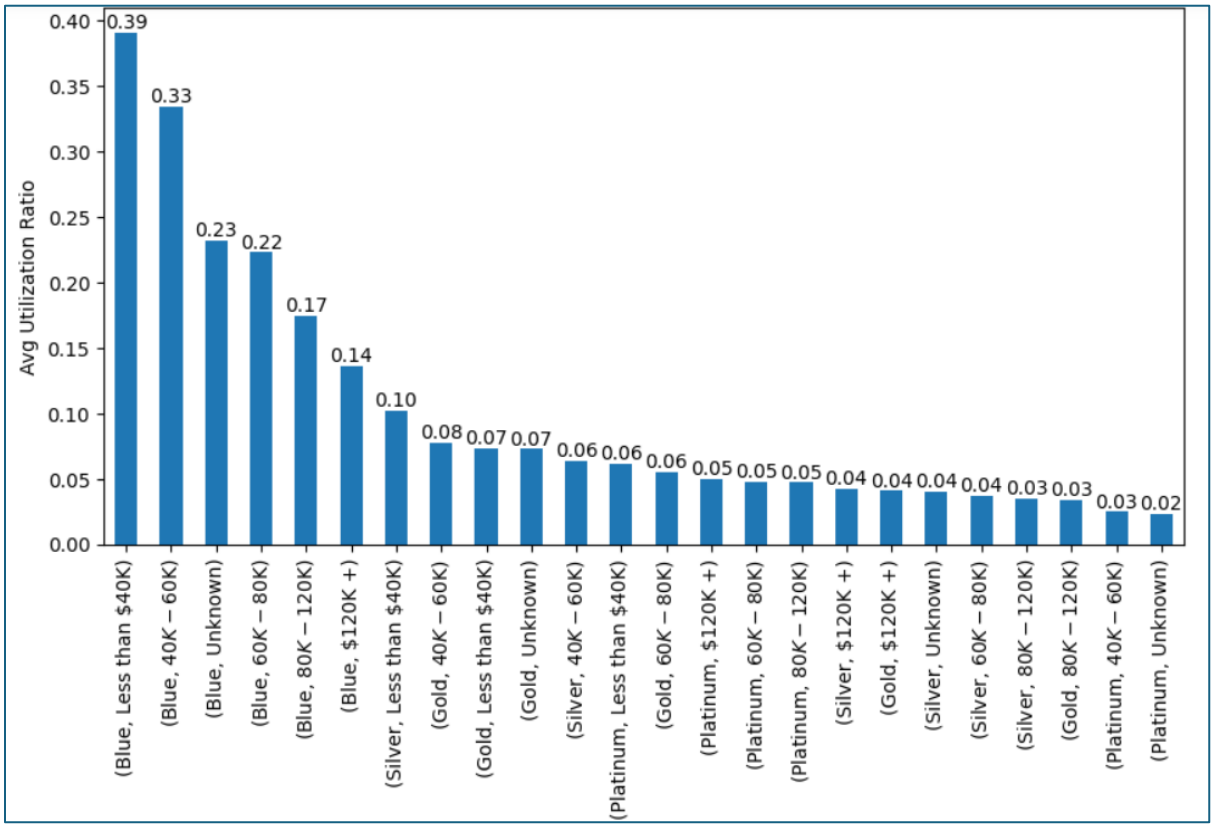
```
import numpy as np

result1 = df.groupby('card_category')['clientnum'].count().reset_index(name='total_customer_count')
result2 = df.groupby('card_category')['attrition_flag'].apply(lambda x: (x == 'Attrited Customer').sum()).reset_index(name='churn

text_table = result1.merge(result2, on='card_category')

text_table['overall_churn_rate_pct'] = np.round(text_table['churned_count'] / len(df) * 100, 2)
text_table['category_churn_rate_pct'] = np.round(text_table['churned_count'] / text_table['total_customer_count'] * 100, 1)
text_table['category_retention_ratio'] = np.round(text_table['total_customer_count'] / text_table['churned_count'], 1)

text_table.sort_values(by='overall_churn_rate_pct', ascending=False)
```

	card_category	total_customer_count	churned_count	overall_churn_rate_pct	category_churn_rate_pct	category_retention_ratio
0	Blue	9436	1519	15.00	16.1	6.2
3	Silver	555	82	0.81	14.8	6.8
1	Gold	116	21	0.21	18.1	5.5
2	Platinum	20	5	0.05	25.0	4.0

A comprehensive examination of the credit card churn rates within the bank's portfolio has unearthed a notable disparity, particularly highlighting the susceptibility of blue cardholders to churn, standing at a considerable 15%. In contrast, customers holding Silver, Gold, and Platinum cards exhibit remarkably low churn rates, all below 1%. The utilization of category-specific churn rates and retention ratios illuminates the distinct characteristics of blue cardholders, emphasizing their higher propensity for churning, a phenomenon potentially amplified by their larger customer base. This insight serves as a crucial starting point for the development of targeted retention strategies.

The revelation that 1 in 4 platinum cardholders has churned raises urgent concerns about the retention dynamics within this exclusive category, especially given its relatively small total customer base of 20 individuals. This unexpected finding prompts a deeper investigation into potential contributing factors, with a particular focus on income categories and other socio-economic variables that may influence customer retention issues within specific card categories. This granular exploration is essential for identifying underlying causes and tailoring effective interventions. By dissecting the intricate interplay of factors influencing churn, the bank can proactively address vulnerabilities, fortify customer relationships, and refine its approach to cardholder retention, thereby ensuring the long-term sustainability and profitability of its credit card portfolio.

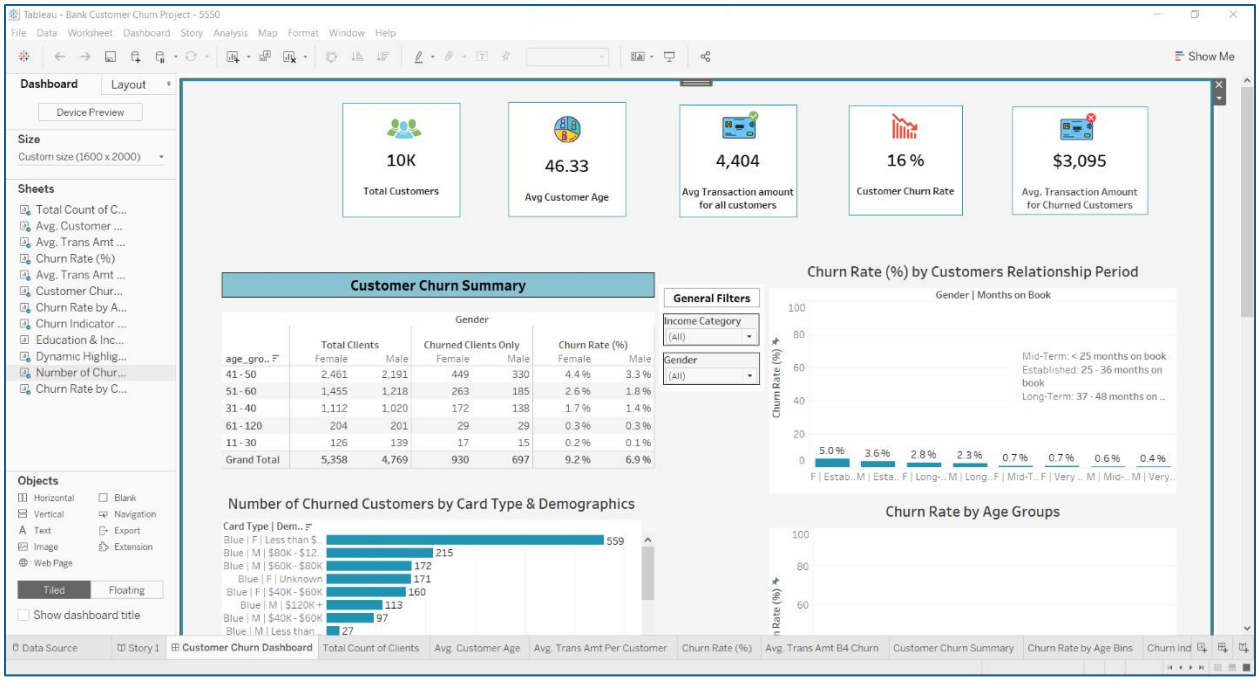
2. Is there a relationship between the credit card category, income category and the usage of credit cards by customers?

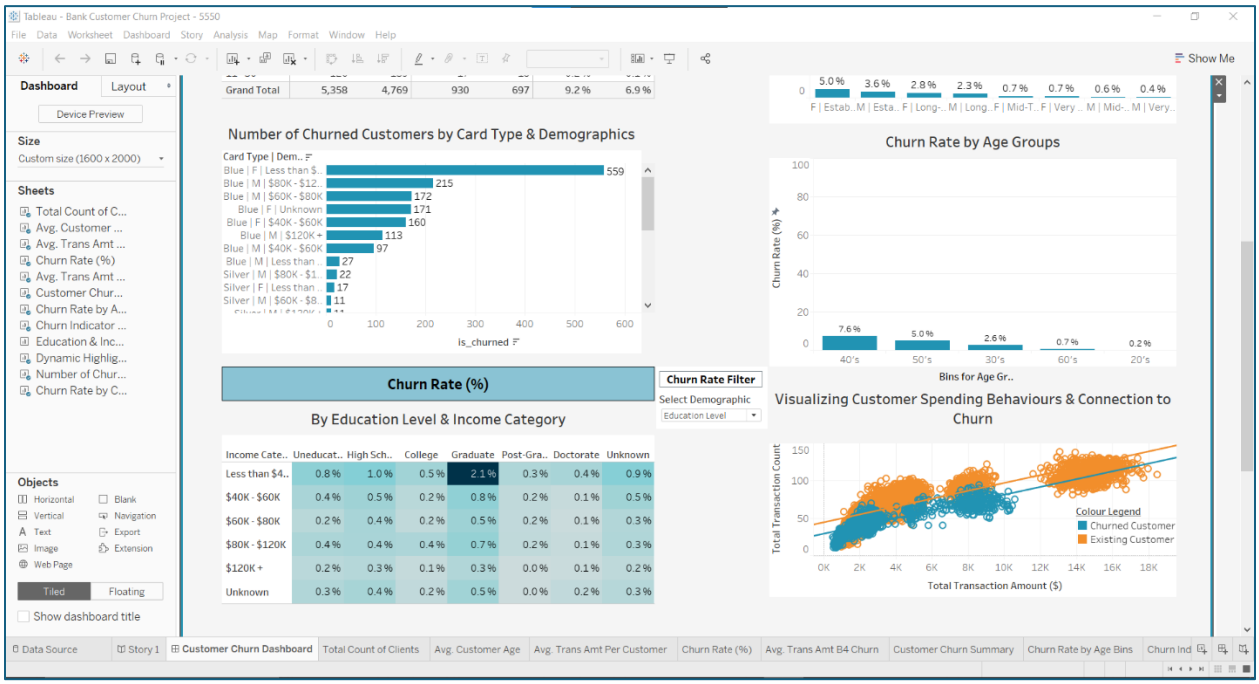


The plot shows that on average, Blue credit card customers who earn less than $40k and those who earn between 40k-60k tend to use their credit cards the most; while Platinum credit card customers who earn between 40k-60k and those whose income category is unknown, tend to use their credit card the least.

On average, Blue credit card customers of all income categories tend to use their cards way more than Silver, Gold and Platinum credit card customers. And average usage trends amongst Silver, Gold and Platinum credit card customers who earn higher than 60k does not differ much, indicating that these customers are not heavily dependent on their credit cards and might also suggest that they are less likely to be interested in trying out other credit products/services the bank offers.

Tableau Dashboard





Additionally, we created a dashboard to better understand and present our data. From the above screenshot of dashboard, it can be inferred that out of 10K customers, The average customer age was found to be approximately 46 years, with the average transaction amount of all customers of $4,404 with an overall customer churn rate of 16%. Then we also found the average transaction amount for churned customers which was calculated to

be $3,095. These insights help the business understand the loss incurred by the churned customers and thus resulting in banks making informed and data driven decisions.

We also created several different charts to visualize the data. They are explained as below:

Customer Churn Summary: This visualization provides an in detailed statistical summary of churned customers.

Churn Rate (%) by customer relationship Period: This Visualization depicts customer churn rate by the time the customers were associated with bank and by their gender.

Visualizing Customer Spending Behaviors & Connection to Churn: visualizing certain customer spending behaviors and their connection to churn if such exists. Such as, comparing total transaction amount and total transaction count of each client and using color to visually identify churned and existing customers.

Churn Rate percentage: comparing Churn rate % among two demographic dimensions, where one is placed on Rows and another on Columns, forming a matrix. for example. education by income, gender by income and so on.

Number of Churned Customers by Card Type & Demographics: Multiple metrics by Clientnum, where each row represents one Client and has multiple metrics as columns such as card type, gender, income range. Also using filters or parameters to let the user drill down into the set of clients they are interested in.

Churn Rate by Age Groups: A simple bar chart which shows the churn rate by various age groups.

Key Insights and Implications

Overall customer Churn: The overall customer churn is 16%, indicating that around one in six customers have switched suppliers. This is a key indicator that the bank can continuously monitor to reduce turnover and increase customer retention.

Transaction Amounts: The dashboard also shows an average transaction amount of $4,404 across all customers, suggesting that the bank's customer base includes customers of various spending levels. However, the average transaction amount per customer switch is $3,095, which is significantly lower than the average for all customers. This may indicate that customers who spend less money on transactions are more likely to leave because they are less invested in the bank's services or do not find them useful. The bank may want to consider strategies to encourage customers to increase their transaction volume to maintain retention rates. For example, they may offer rewards programs or

incentives to customers with high transaction volumes or balances. Alternatively, they may explore ways to improve their service or product offerings to make them more attractive to customers with lower transaction volumes.

Customer Demographics: Overall, the average customer age is 46, with more female customers than male customers, and most customers between the ages of 41 and 50. The turnover summary shows that female customers aged 41-50 also have the highest turnover, 4.4% of 2461 female customers in this age group, 3.3% of 2191 male customers in the same age group. Overall, female turnover is higher at 9.2 percent across all age groups compared to 6.9 percent for males across all age groups. According to the analysis, established customers with the highest turnover (those who have been with the bank for 25-36 months), women have 5% and men 3.6%. The second largest turnover is for long-term customers (37-48 months with the bank), 2.8% for women and 2.3% for men.

The analysis also shows that the highest number of problem customers were female blue-chip credit cardholders earning less than $40,000, with a total of 559. The second highest number, at 215, were male blue-chip credit cardholders earning between $80,000 and $120. k. However, the majority of customers in all income categories had blue credit cards. Both male and female customers were replaced by established and long-term customers of the bank. The turnover rate for male Blue Card holders ranged from 97 to 215 in the $40,000-$120,000+ income bracket, and all Blue Card holders who switched were long-term customers of the bank. This information can be used to tailor marketing and communication efforts to specific demographics to reduce customer churn and increase customer retention.

Visualization of customers' Spending behavior: Visualization of customer spending behavior and link revenue shows that customers with higher transaction volume and higher transaction volume are less likely to be silent. Additionally, the spread shows that customers who made it tough made less than 100 transactions before switching and typically spent less than 5,000, regardless of income category. This suggests that offering customers incentives to maintain high activity and transaction volumes can be an effective retention strategy.

Limitations

- **Data Scope**

  It is imperative to acknowledge that while the insights derived from our analysis are rooted in existing data, the scope of our examination may not comprehensively account for external factors that could potentially influence customer behavior. External elements such as economic conditions, industry trends, or competitive

actions can play a pivotal role in shaping consumer preferences and decision-making. Our analysis, while robust within the confines of the provided dataset, may not capture the dynamic interplay of forces beyond its boundaries. Therefore, the interpretations and conclusions drawn should be viewed in the context of the dataset's limitations, and it is recommended to consider external factors when making strategic decisions or drawing broader implications for business strategies. This caveat underscores the importance of a comprehensive approach that integrates both internal data analysis and an awareness of external dynamics for a more nuanced understanding of customer behavior.

- **Causation vs. Correlation**

  While our analysis successfully identifies correlations between various customer characteristics and the occurrence of churn, it is crucial to emphasize that correlation does not imply causation. The observed associations merely highlight statistical relationships without establishing a direct cause-and-effect relationship. To gain a more comprehensive understanding of the underlying reasons for customer churn, additional research is warranted. Further investigations may involve qualitative methods such as customer surveys, interviews, or in-depth case studies to unearth the nuanced factors contributing to churn. By delving deeper into customer experiences, feedback, and interactions, we can uncover insights that go beyond the scope of quantitative correlations, providing a more holistic perspective on the drivers of churn. This recognition of the need for additional research underscores the importance of adopting a multifaceted approach to comprehensively grasp the intricacies of customer behavior and churn dynamics within the studied context.

- **Dynamic Nature of Customer Behavior**

  Recognizing the dynamic nature of customer behavior, it is crucial to emphasize that the analysis presented in this report offers a snapshot of a specific moment in time. Customer preferences, influenced by a range of factors, are inherently subject to change over time. Therefore, continuous monitoring becomes an essential component of strategic planning, enabling businesses to stay attuned to evolving trends and adapt their approaches accordingly. The static nature of the current analysis underscores the importance of establishing mechanisms for ongoing data collection and analysis. By embracing a continuous monitoring framework, organizations can proactively identify shifts in customer preferences, respond to emerging trends, and remain agile in a rapidly changing business landscape. This adaptive strategy ensures that business decisions are not solely based on historical patterns but are informed by real-time insights, fostering a

more resilient and responsive approach to meeting customer expectations, and staying competitive in the market.

Future Work

- **Qualitative Research:** Engaging in qualitative research methodologies, such as customer interviews or surveys, holds the potential to yield profound insights into the intricacies of customer motivations and preferences, thereby significantly augmenting our comprehension of the factors influencing churn. Unlike quantitative data, which may provide statistical trends and patterns, qualitative research allows for a more nuanced exploration of the underlying reasons behind customer behaviors. Through direct interactions with customers, we can capture subjective experiences, perceptions, and sentiments that quantitative analysis alone may not fully unveil. By delving into the qualitative realm, businesses can uncover the qualitative dimensions of customer churn, gaining a deeper understanding of the emotional, social, and contextual factors that contribute to customer decisions. This holistic approach not only enriches the analytical landscape but also equips organizations with the qualitative context necessary to develop targeted and effective retention strategies that resonate with customer needs and preferences on a more personal level.
- **Predictive Analytics:** The adoption of machine learning techniques for developing predictive models presents a strategic avenue for businesses to anticipate and address potential customer churn. By leveraging advanced algorithms and historical data, these models can analyze patterns and indicators associated with customers who have previously exhibited churn behavior. This proactive approach enables businesses to identify early warning signs and predict the likelihood of churn for individual customers. Armed with this foresight, organizations can implement targeted retention strategies, offering personalized interventions to mitigate the factors contributing to customer dissatisfaction. Predictive modeling not only allows for a more efficient allocation of resources by focusing on high-risk customers but also empowers businesses to tailor retention efforts to specific customer segments. By embracing machine learning in this context, organizations can enhance their customer relationship management, fostering a proactive and data-driven approach to customer retention that goes beyond reactive measures.
- **Longitudinal Analysis**

  Delving into a longitudinal analysis of customer behavior trends holds the potential to unveil intricate patterns and seasonal variations that exert an influence on churn dynamics. While the current snapshot provides valuable insights, an

extended examination across time frames allows for a deeper understanding of recurrent behaviors and fluctuations. Recognizing patterns over an extended period enables businesses to anticipate and respond to seasonal shifts, identifying peak periods of customer attrition or retention. This nuanced perspective not only aids in predicting potential churn but also empowers strategic interventions tailored to specific periods or trends. By extrapolating insights from a more extended timeline, businesses can implement targeted measures, such as personalized marketing campaigns or enhanced customer engagement strategies, to address the unique challenges presented by varying seasons or specific temporal patterns. Consequently, this comprehensive approach to customer behavior analysis supports a more initiative-taking and informed churn mitigation strategy, fostering a sustainable and resilient customer retention framework.

- **Cost-Benefit Analysis**

  Assessing the cost-effectiveness of the proposed retention strategies is paramount for strategic decision-making within the banking sector. By carefully evaluating the potential returns on investment associated with each proposed initiative, banks can strategically prioritize and implement interventions that offer the greatest impact on customer retention. This financial scrutiny ensures that resources are allocated judiciously, optimizing the balance between investment and expected outcomes. Understanding the cost-effectiveness of retention strategies allows banks to navigate the intricate landscape of customer relationship management with a keen eye on efficiency and efficacy. This approach not only enhances the institution's ability to retain valuable customers but also contributes to the overall financial health of the bank by aligning expenditures with anticipated returns. Consequently, a comprehensive evaluation of cost-effectiveness serves as a guiding principle, enabling banks to make informed decisions and deploy resources in a manner that maximizes the effectiveness of their customer retention initiatives.

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