MGMT 590V Visual Analytics

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Final Report

Credit Card Adoption and Usage: Insights from US & India

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INTRODUCTION & BACKGROUND

Credit cards have become an essential component of modern financial systems, revolutionizing the way consumers access credit and manage spending. Since their introduction by the Diner's Club in the 1950s, credit cards have evolved into one of the most widespread payment methods globally, particularly due to their convenience, ease of credit access, and rewards programs. However, the patterns of credit card adoption and usage vary significantly across different regions, driven by factors such as employment, education, and income levels.

Over the years, credit card adoption has risen steadily in both developed and developing economies, becoming a key component of modern financial systems (Outlook Money,2023). In the United States, credit card usage is deeply embedded in consumer culture, with millions relying on cards not only for daily transactions but also for managing debt. This widespread reliance on credit cards has been shaped by various factors, including financial literacy, access to credit, and evolving consumer habits. Research shows a direct link between financial literacy & credit card behaviour. Consumers with higher financial education tend to use credit more responsibly, avoiding high-interest debt and late payments. This underscores the importance of promoting financial literacy to help consumers manage credit wisely (Joshua et al., 2011).

The COVID-19 pandemic significantly altered global credit card usage patterns, particularly in the United States (Robert et al., 2021). As economic uncertainty intensified and unemployment rates surged, consumer spending via credit cards saw a marked decline. Studies have shown that during this period, many consumers shifted their financial priorities, reducing discretionary spending and focusing on paying down existing debt (Prachi B., 2020). This behaviour resulted in a notable reduction in credit card balances, reflecting a broader trend of Americans adjusting their financial habits in response to economic challenges.

Given the importance of credit card spending in driving consumption and economic growth (Charlotte M.,2024), it is critical to understand how different demographics use this financial tool. In a growing economy like India, credit card adoption has been more gradual due to differences in financial infrastructure, consumer preferences, etc. However, with rapid urbanization and financial inclusion initiatives, its usage is also gaining traction in India a part of which is shown in this analysis. (Sriram K.V, 2023).

OBJECTIVES & GOALS

The goal of this project is to analyze credit card adoption and usage patterns in the United States to understand the socioeconomic factors influencing consumer behavior. By analyzing credit card transaction data from January 2019 to June 2020, we aim to identify how education, unemployment, and income affect credit card adoption in the US. Month wise credit card spending in India is compared with US for the period to draw insights into the adoption trends.

The stakeholders of this project include consumers, financial institutions, policymakers, and credit card issuers in both regions. Through this analysis, we hope to offer insights into how credit access and spending patterns vary across demographics and regions.

By carrying out this analysis, we aim to contribute to a better understanding of the role credit cards play in economic growth and financial inclusion. The ideal outcome would be to provide actionable recommendations that help policymakers and financial institutions promote responsible credit use, improve access to credit in underserved areas, and foster more inclusive economic participation in the U.S.

DATASETS

To analyze credit card spending patterns in the United States and India, we have acquired five datasets. These datasets provide critical insights into various demographic factors, including credit card transactions, household income, unemployment rates, education levels, and credit card spending behavior in both countries. By leveraging this data, we aim to uncover trends and correlations that will enhance our understanding of consumer credit card usage.

DATASET No.	DATASETS	DESCRIPTION
1	US Credit Card Transactions	This Kaggle dataset, compiled by Priyam Choksi, contains 1.3M US credit card transactions data (from Jan 2019–June 2020) that can be used for financial analysis and fraud detection. Key variables include transaction time, amount, category, cardholder demographics (DoB, gender, occupation), location (city, state, zip, coordinates). It allows to visually analyze spending behavior across demographics at city and state levels in US.
2	Median Household Income (US)	Sourced from the Digest of Education Statistics by National Center for Education Statistics (NCES), this 29KB Excel file provides yearly median household income for each US state. It is available for use by researchers, policy analysts, media, and the public. This dataset can help visually analyze the impact of income on state-wise credit card spending in the US.
3	Unemployment (US)	This Kaggle dataset is a 3MB CSV file collected from Bureau of Labor Statistics, that can be used to study & track unemployment per US state. Key variables include state, month, year, total and % of employed and unemployed, along with population for each state in US from 1976-2022. This allows for graphical analysis of how unemployment influenced state-wise credit card spending in US from Jan 2019 to June 2020.
4	Education level (US)	Sourced from the Digest of Education Statistics by NCES, this dataset provides yearly data on number of individuals aged 18+ by education level, sex, race/ethnicity, and age. The 2019 file is 81KB, and the 2020 file is 79KB. Though not state-specific, it can visually show the influence of age, gender, and education level on credit card spending in the US.
5	India Credit Card Spending	Sourced from the Reserve Bank of India, this dataset provides monthly ATM and card statistics for all Indian banks, aimed at supporting research. It includes data on credit vs. debit card transactions at POS and ATMs, as well as the amounts spent. To compare with the US dataset, data from Jan 2019 to June 2020 will be combined. Each monthly dataset is about 20KB excel file. Although not location-specific, it offers visual insights into spending behavior at national level between India and the US.

We connected Dataset 2 to our primary Dataset 1 using a Left Join. Data blending was used for Datasets 3, 4, and 5, matching on state name, age buckets, and Month-Year fields, respectively, with Dataset 1.

DATA STORY

The American Landscape: A Mosaic of Spending Habits

Our journey begins with a closer look at the United States, where credit card usage is deeply ingrained in consumer culture.

Demographic and Geographic Spending Patterns

Graph 1: Gender-wise Spending Across Categories

We used a bar chart to display gender-wise spending across the "Top N" spending categories. The average money spent by men and women was placed on the Rows shelf, with a parameter allowing users to adjust the number of top categories displayed. Insights revealed that men tend to spend more on high-value categories like travel, while women spend more on everyday items such as clothing and personal care. Selecting a specific category in this bar chart filters the accompanying line chart to show age-wise spending trends for that category, helping to analyze patterns across both gender and age.

Graph 2: State-wise Spending Visualization

Moving to a geographical perspective, the team used a map chart to visualize spending by state, ranking total spending and average income per state. Darker shades on the map represent higher spending, while lighter shades indicate lower spending. Clicking on a state filters gender and age-group spending charts based on that state's data. Insights reveal that states with higher median incomes, such as DC and MA, tend to spend less, suggesting higher savings or controlled spending. Conversely, Southern states like Mississippi and Alabama, with lower average incomes, tend to spend more, reflecting a different consumption pattern. This chart helps identify spending trends and patterns by geography.

Graph 3: Age-wise Spending Over Time

A line chart is used to display total spending by different age groups over time. The chart highlights that younger age groups, particularly those aged 25-44, consistently spend more and exhibit higher spending peaks in December, suggesting active lifestyles and family-related responsibilities. In contrast, older age groups (65+) show lower but more stable spending patterns, likely influenced by retirement and fixed incomes. These insights provide a clear view of how spending behaviors differ by age, with younger consumers driving holiday season spending while older consumers maintain steadier trends throughout the year.

Diving Deeper: Transactions, Fraud, and Socioeconomic Factors

Graphs 4, 5, 9 utilizes the credit card transactions & categories of spending in the US from January 2019 to June 2020, sourced from dataset 1.

Graph 4 displays a side-by-side bar chart & utilizes the number of transactions across categories, with the right side displaying a fixed LOD (Level of Detail) calculating number of transactions at the date level. Gas and transportation transactions consistently lead, with grocery and home categories also showing stable high usage. Lower transaction volumes in travel and online grocery shopping suggest less frequent use of credit cards in these areas. Most categories show small differences between actual and fixed LOD numbers, typically 2-4K transactions. This suggests minor day-to-day fluctuations in transaction volumes. The fixed LOD calculation may smooth out some daily fluctuations, potentially masking short-term trends or anomalies. This graph fulfills our project goal by breaking down credit card usage across spending categories, identifying sectors with higher adoption, and offering insights into consumer behavior. These findings can guide financial institutions in product development and inform policymakers about credit usage patterns. The slight differences between actual and fixed LOD calculations suggest potential date-specific factors influencing credit card usage, warranting further investigation into temporal patterns.

Graph 5 provides dual view & compares spending amounts and transaction counts for the top 6 states by expenditure. It uses two parameters (select measure & select agg) and two calculated fields (dynamic measure & dynamic agg). This provides users an option to toggle between amount or transaction metrics, and select total, average, or median aggregates for analysis. TX and CA lead in credit card spending and transactions, followed by New York, reflecting their large populations and strong economies. All top-spending states show seasonal peaks in December and dips during the March-April 2020 COVID-19 period, with a gradual recovery post-pandemic. The focus on top-spending states may not represent the full picture of credit card usage across the entire U.S as other factors like income, education, employment in these states is not considered in this graph. This graph addresses our project goal by showcasing credit card adoption and usage patterns in economically significant U.S. states. It enables analysis of both spending amounts and transaction volumes in high-activity areas, demonstrating the impact of major events like the pandemic. Stakeholders benefit from insights into trends in high-value markets, state-level responses to economic events, and seasonal patterns in top markets, informing decisions for financial institutions, policymakers, and credit card issuers.

Graph 9 highlights an anomaly in the complete dataset, where Delaware shows the highest average spend of $514 but a total spends of $4,630 from 9 transactions in April 2019, with no data for other months, indicating a data limitation. A parameter (select measure) is utilized to toggle between transaction count & amount spent.

Socioeconomic Factors and Credit Card Usage

Graph 6: Income, Unemployment, and Credit Card Fraud

Graph 6 visualizes the complex relationship between average income, unemployment, and credit card fraud across U.S. states in 2019. The data is sourced from dataset 1 (credit card frauds), dataset 2 (median income in $), and dataset 3 (unemployment) and mapped across all US states. The size of symbol represents total frauds & color intensity signifies total employed labor force across each state. This shows a correlation between unemployment and credit card frauds across US states, with examples like CA, TX showing both high unemployment & high credit card frauds. The map doesn't account for population differences, which could

provide more context to the fraud and unemployment numbers. It highlights economic disparities that can inform financial institutions, policymakers, and credit card issuers on fraud risks, credit access opportunities, and targeted interventions for unemployment and fraud prevention.

Graph 7: Income, Employment, and Credit Card Spending
Graph 7 visualizes the complex relationship between average income, % of employment, and credit card amount spent across Top N U.S. states in 2019. The data is sourced from dataset 2 (median income in $), dataset 3 (% of employed labor force), and dataset 1 (credit card amount spent in $) and mapped across all US states. While there is a correlation between income & employment, other factors like lifestyle/economic behaviors contribute to spending patterns. The dataset, focused on 2019–2020, may not capture long-term trends or post-pandemic changes, and state-level data may hide variations within sub-regions or urban vs. rural areas. This graph supports our objectives by emphasizing the need for policymakers to improve credit access in low-income regions, guiding financial institutions to tailor products for high-income areas, and helping credit card issuers focus on high-usage regions like D.C.

Graph 8: Population, Unemployment, Income, and Credit Card Spending
Graph 8 explores how population size (dataset 1), % unemployed labor force (dataset 3), median income (dataset 2), and credit card spending (dataset 1) vary across Top N spending states, aiming to identify the socioeconomic factors that influence consumer credit card adoption and usage. High populated states (CA, NY) have higher unemployment rates but show higher average incomes, while smaller states (MN, VA) have lower unemployment rates & comparatively lower incomes. Spending amounts appear relatively consistent across states, despite variations in other factors. This analysis only covers year 2019 and might not reflect longer-term trends or the impact of post-pandemic economic conditions. It addresses our objectives by highlighting the need for policymakers to enhance credit education in low-income regions and guiding financial institutions and credit card issuers in developing targeted strategies for high-income and moderate spending areas.

The Education-Age-Spending Nexus

Graphs 10, 11: Education Levels and Age-wise Spending
Graphs 10 and 11 reveal a compelling connection between age, education levels, and credit card spending. In Tableau, the team used "Age buckets" and "Measure Values" for the education-level chart and "Age Bins" for the spending chart. We placed "Age buckets" on the Columns shelf and "Measure Values" on the Rows shelf, with different education levels, color-coded for comparison. For the credit card spending chart, the group used "Age Bins" in the Columns shelf and the Summation of the amount (amt) spent in the Rows shelf, adding clusters to show spending peaks, especially in the 30-44 age group. Insights show the 18-24 group has low education and spending, offering financial literacy promotion opportunities. The 55-64 group still contributes $5M-$6M, ideal for retiree-focused products. The 30-44 group spends the most, making them suitable for premium products. These charts help connect age, education, and spending, offering actionable insights for targeted financial products.

A Tale of Two Nations: USA vs. India
Our analysis takes a global turn with Graphs 12-16, comparing credit card usage patterns in the USA and India.

Graphs 12, 13: Credit Card Spending Patterns in USA and India
We developed a tree map to examine credit card spending patterns in the USA and India from January 2019 to June 2020. The visualization was made by aggregating the Amount spent (Amt field) for the USA and aggregating the credit card spending for India, categorizing each month by its spending percentage. Since the currencies of the USA and India differ, and we want to compare spending over the period accurately, we needed to convert the Indian Rupee (INR) spending to USD using Purchasing Power Parity (PPP) values for 2019 and 2020. This ensured an apple-to-apple comparison of spending in both countries. The USA data shows a notable spike in December 2019, likely due to holiday shopping, highlighting the potential for seasonal

promotions. In contrast, India's spending peaks during festive months, such as October 2019 and January 2020, presenting an opportunity for tailored rewards around major festivals. Both countries experienced spending declines during April-May 2020, which could be addressed by promoting essential services during low-spending periods.

Graphs 14, 15: Credit Card Transactions in USA and India
The team used two-line graphs to analyze the number of credit card transactions in the USA and India from January 2019 to July 2020. The graph for the USA highlights a peak in transactions in January 2020 (141K, 11%), followed by a steep decline in April 2020 (48K, 4%) due to the pandemic. The USA's post-pandemic recovery was quicker, with transactions stabilizing after the April dip. In contrast, India's graph shows a higher transaction peak in October 2019 (160K, 7%) and a significant decline to 60K (2%) in April 2020. India's recovery was slower, reflecting stricter lockdowns or a more pronounced economic impact. Key insights suggest that credit card companies could offer deferred interest promotions, credit card insurance, or enhance digital engagement to support customers during crises like the pandemic.

Graph 16: Total Transactions and Spending in India & USA
Graph 16 illustrates the total number of credit card transactions and amount spent for India & USA from January 2019 to June 2020. It utilizes transactions & amount spent in India (dataset 5) and USA (dataset 1). There's no breakdown by demographic factors or spending categories, limiting insights into specific adoption patterns. It addresses our project goals by visualizing credit card adoption trends in India over time, highlighting significant shifts in usage, and showing the impact of major events like the pandemic. It provides stakeholders with insights into market growth potential, the effects of policy changes, and opportunities for credit card issuers to expand in high-activity periods.

The Shifting Landscape: Credit vs. Debit

Graphs 17, 18: Credit and Debit Card Spending Comparison
Graph 17 is a box and whisker plot showing credit and debit card spending in 2019 and 2020. Both spending types peaked in January but dropped sharply in April 2020. The plot shows wider spending variation in 2019, with 2020 indicating a more restrained consumer behavior due to the pandemic. Graph 18 is a combined line and bar chart, comparing credit card (bars) and debit card (line) transactions. Debit card usage remains constant until November 2019, when credit card usage starts overtaking Debit card usage, and a dip in both types is observed during April 2020 due to lockdowns.

Charting the Future of Credit

Our analysis reveals the complex factors shaping credit card usage, influenced by gender, age, geography, and global events. Policymakers should focus on financial education in lower-income regions, while financial institutions can develop tailored products for different demographics, such as premium options for high spenders or specialized cards for retirees. Seasonal spending trends suggest issuers could offer targeted rewards during peak months. The comparison between the USA and India highlights the need to consider cultural and economic contexts when expanding into new markets. As digital payments accelerate post-pandemic, stakeholders should enhance digital engagement and provide support during downturns. Promoting responsible credit use and improving access to financial services will drive financial empowerments for all.

SUMMARY

The comprehensive analysis of credit card usage in the US and India reveals intricate patterns influenced by **socioeconomic factors, regional trends, and consumer behavior**. In the U.S., credit card usage is deeply ingrained in consumer culture, with **spending patterns varying significantly across demographics and regions**. Higher-income states tend to exhibit more controlled spending, while lower-income regions show higher consumption rates. **Age and gender play crucial roles**, with the 30-44 age group leading in spending

and distinct category preferences between genders. India demonstrates a **gradual but steady increase in credit card adoption**, driven by urbanization and financial inclusion initiatives. Both countries exhibit clear seasonal spending trends, with the U.S. peaking during holiday shopping and India during festive months. The **COVID-19 pandemic significantly impacted credit card usage** in both nations, although with differing recovery rates. The analysis also highlights the **growing preference for credit over debit cards** in India and the influence of factors such as **education and income levels on responsible credit use** as seen in U.S. Notably, gas and transportation consistently dominate credit card transactions in the U.S., while both countries show a correlation between population size and credit card spending.

CONCLUSIONS

The findings underscore the importance of **tailored strategies for different regions and demographics** in promoting responsible credit use and financial inclusion. Financial institutions and policymakers can leverage these insights to develop **targeted products, services, and regulations** that address the specific needs of various consumer segments. There's a clear opportunity to **improve credit access and financial literacy in low-income regions**, particularly in India where digital payment adoption is rapidly increasing. The observed spending patterns serve as **valuable economic indicators**, highlighting the need for adaptive policies during economic shifts like the pandemic. Stakeholders should focus on **encouraging prudent financial behavior across all demographics** while remaining attentive to evolving trends in digital finance. The analysis reveals the potential for **seasonally targeted promotions and crisis-response strategies**, such as offering deferred interest during economic downturns. Moving forward, it's crucial to address the **disparities in credit card usage among different education and income levels**, potentially through tailored financial education programs. Further research into the **long-term implications of these patterns**, especially in light of post-pandemic economic changes and the **increasing shift towards digital payments**, will be essential for developing sustainable financial ecosystems in both countries and **promoting global financial inclusion**.

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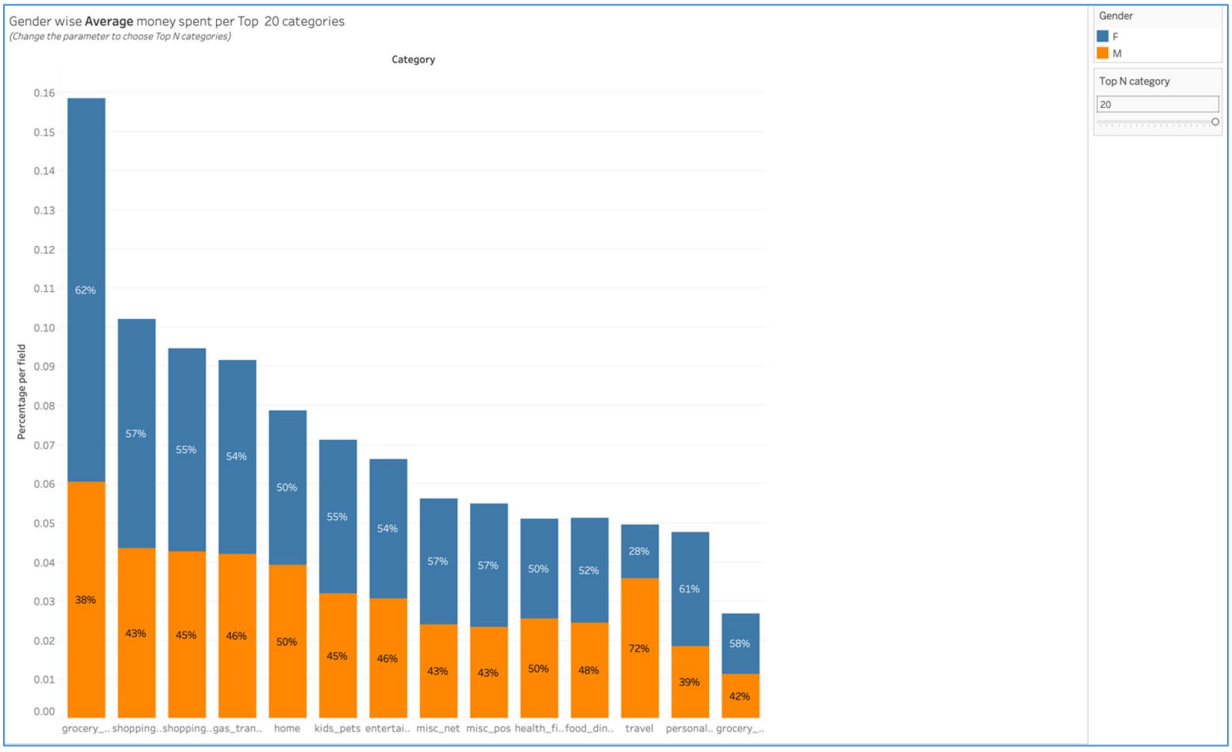
CONTRIBUTIONS

Farha	Contributed to developing the Goals and Objectives for Milestone 2 and the Introduction to the Topic for Milestone 1. Opened the presentation during the class session and assisted in creating content for graphs 4, 5, 6 7and 8.
Namra	Contributed to the introduction, background, and references for Milestone 2, and conducted data exploration for Milestone 1. Took responsibility for ensuring the timely submission of the final project during a critical

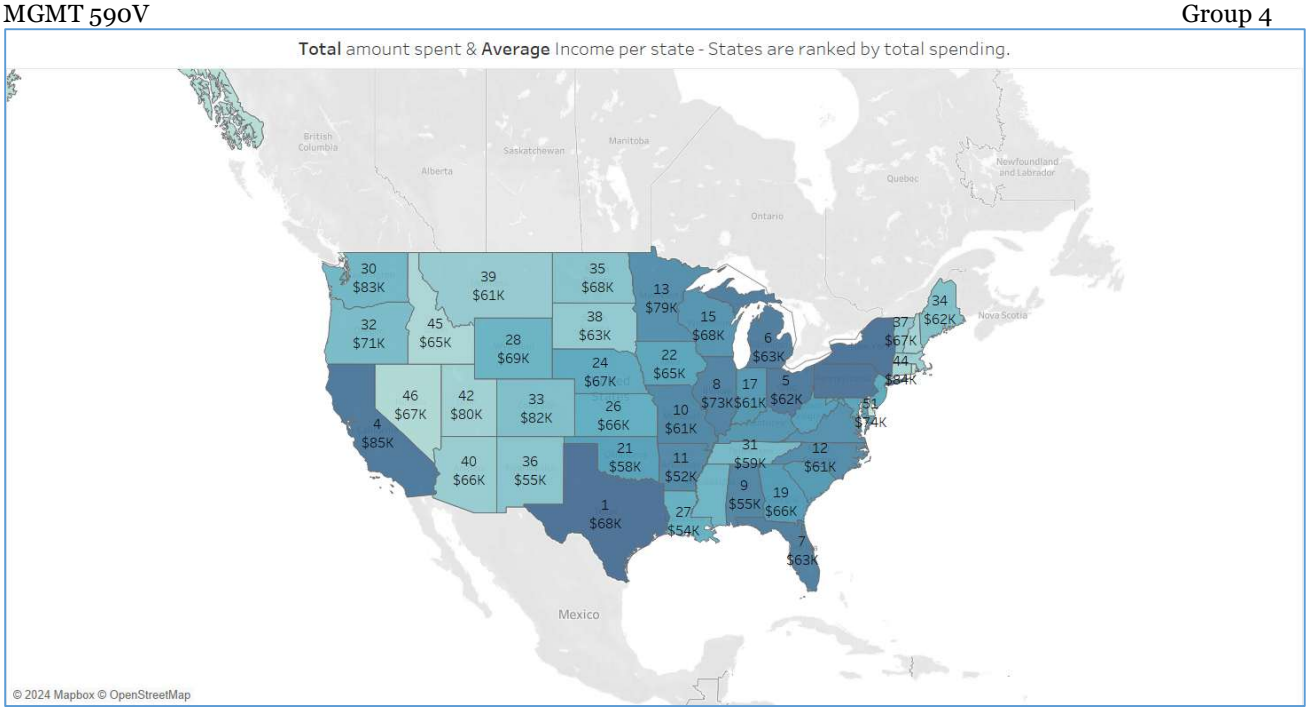
	deadline. Assisted in creating visualizations (graphs 10-15 & 17-18) for the comparison of credit spending between India and the USA.
Rohan	Contributed to the visualization plan, dataset-to-chart relationship mapping, and drafted charts for Milestone 2, along with dataset exploration for Milestone 1. Developed visualization graphs 1-3 and assisted team members with Tableau-related technical challenges. Presented the spending patterns across male and female product categories during the presentation.
Subbaiah	Contributed to the visualization plan, mapped dataset-to-chart relationships, and drafted charts for Milestone 2, while also conducting dataset exploration for Milestone 1. Developed visualization graphs 1-3 and assisted in building the final dashboard and adding parameters to the project.
Swanand	Contributed to the introduction, background, and references for Milestone 2, and worked on defining the project scope for Milestone 1. Collaborated with Namra in developing the visualizations (graphs 10-15 & 17-18) comparing credit card spending and transactions between India and the USA and presented this section during the class presentation.
Vaishnavi	Worked on datasets part for milestone 2 & on research articles for Introduction, dataset exploration for milestone 1. Created graphs 6-8 which were presented during the class session. Created additional graphs (3-5,9,16) to include concepts taught in class. Worked on collating all dashboards into a single tableau story presentation. Did final reviews for all 3 team submissions ensuring all rubric points are covered.

APPENDIX

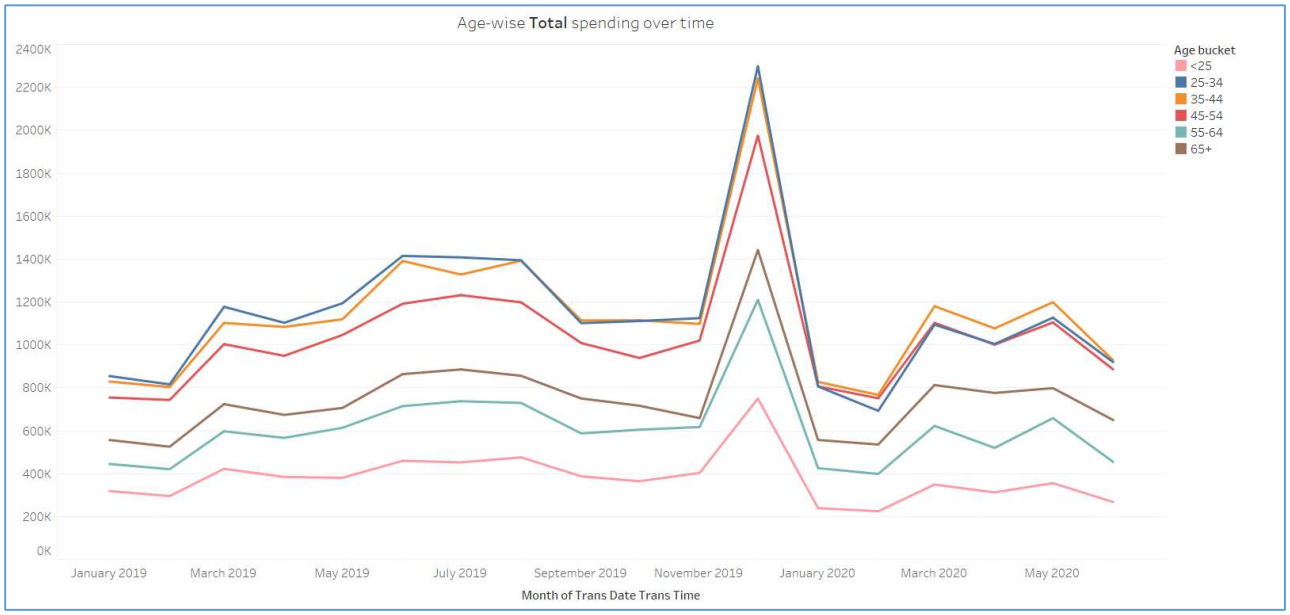
Graph 1: Stacked Bar Chart depicting *"Average Credit Card Spending by Gender for Top N categories"*



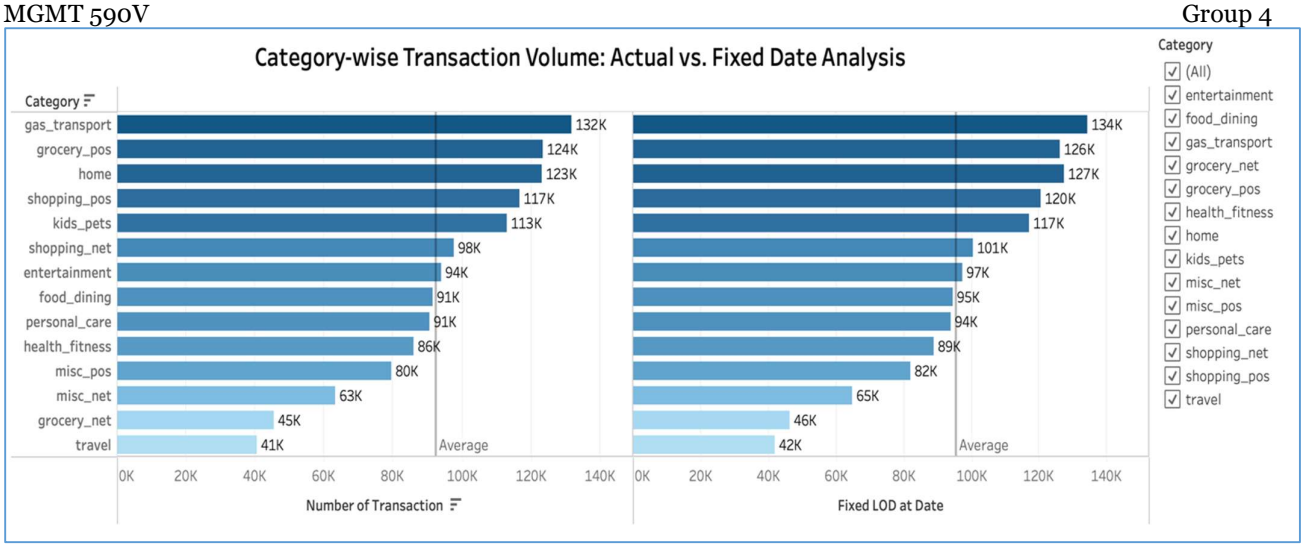
Graph 2: Filled map showing *"Relation between total credit card spending & median income per US State, indicating state ranks for spending in 2019"*



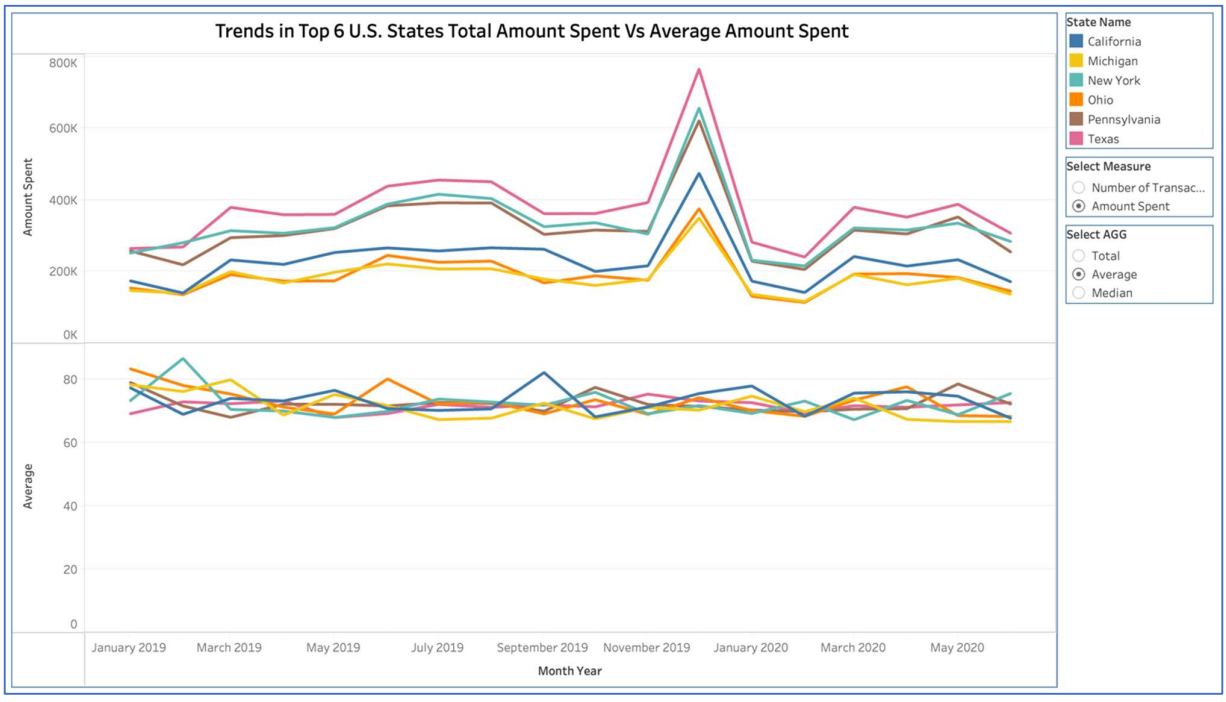
Graph 3: Line Chart depicting ***"****Age-wise Spending Over Time"*



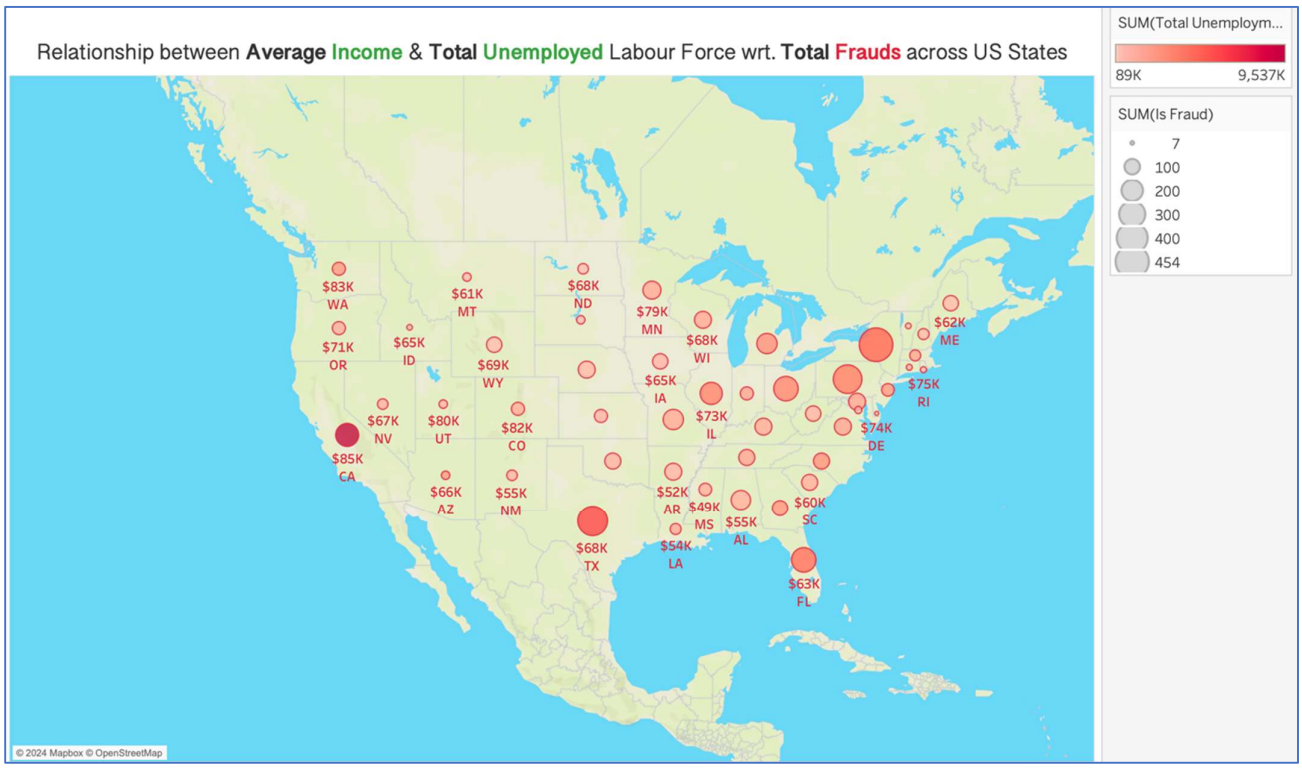
Graph 4: Side by Side Bar Chart showing ***"****Category-wise Credit Card Transaction Volume: Actual vs. Fixed Date Analysis"*



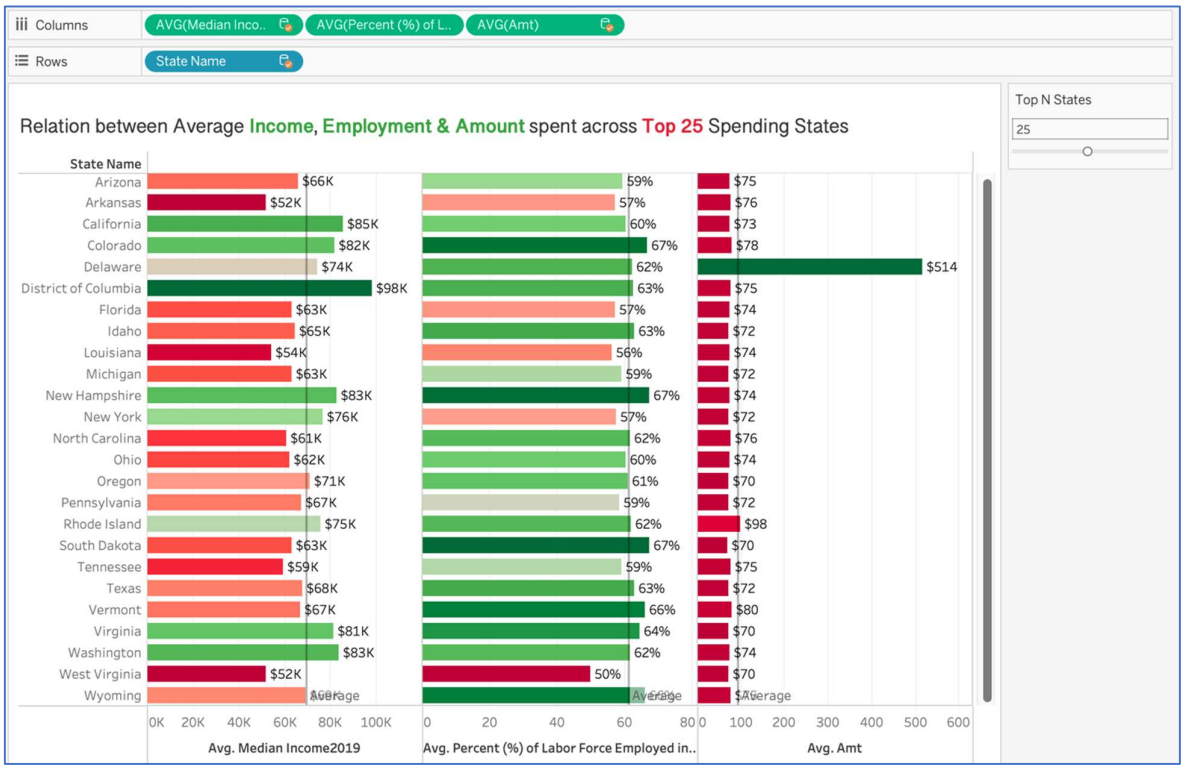
Graph 5: Line Chart showing *"Credit Card Usage Trends in Top 6 U.S. States by Total Spending (2019-Jun' 2020)"*



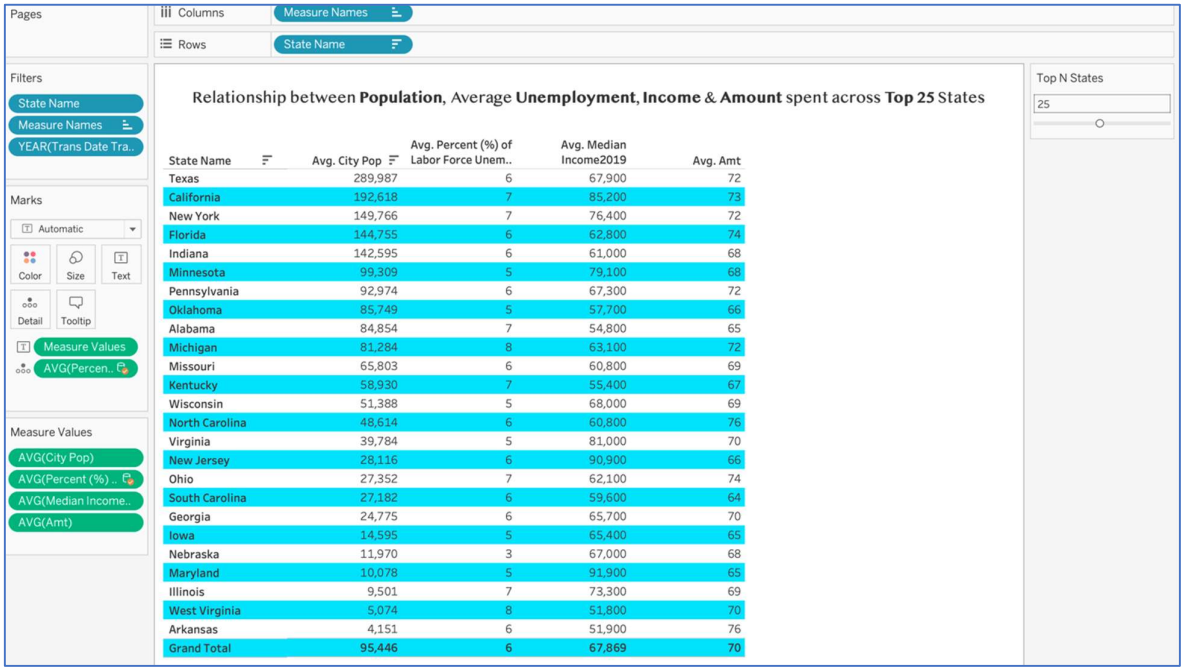
Graph 6: Symbol Map showing *"Interplay of Income, Unemployment, and Credit Card Fraud Across U.S. States (2019)"*



Graph 7- Side by side Bar chart showing *"Credit Card Spending, Income, and Employment Trends Across Top 25 US States: Insights on Economic Influences"*

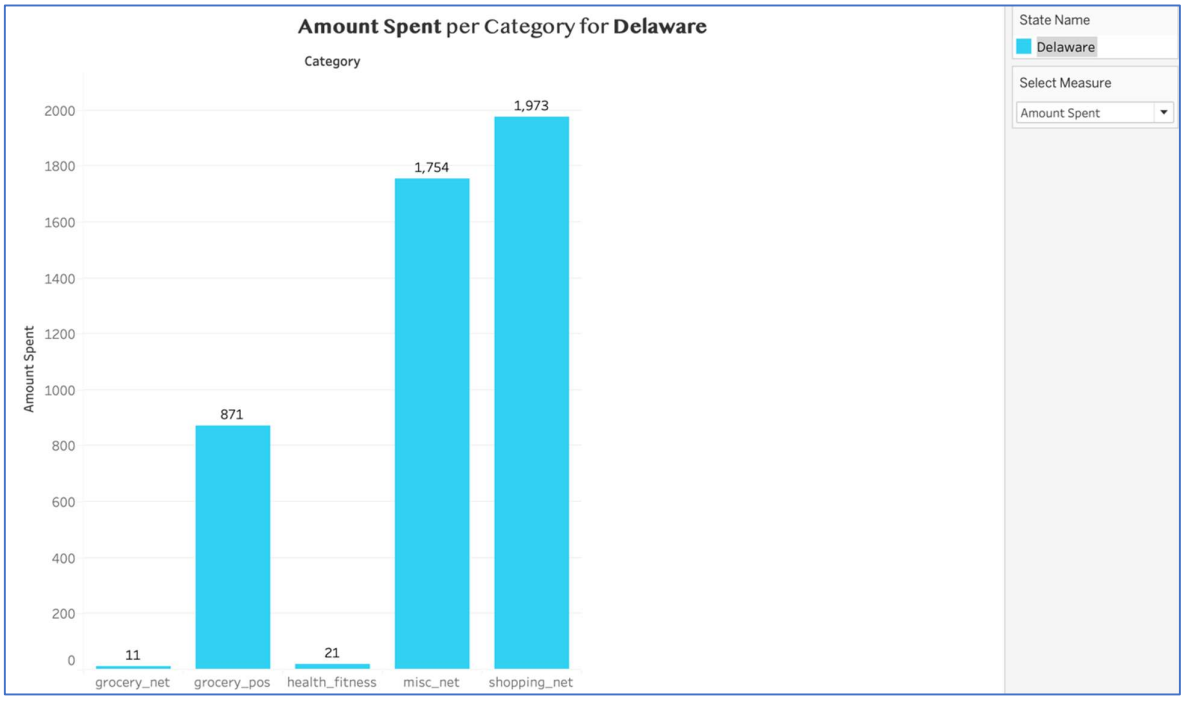


Graph 8- Crosstab Analysis of "*Credit Card Spending Patterns: with Population, Unemployment, Income, and Spending in **Top N** U.S. States*"

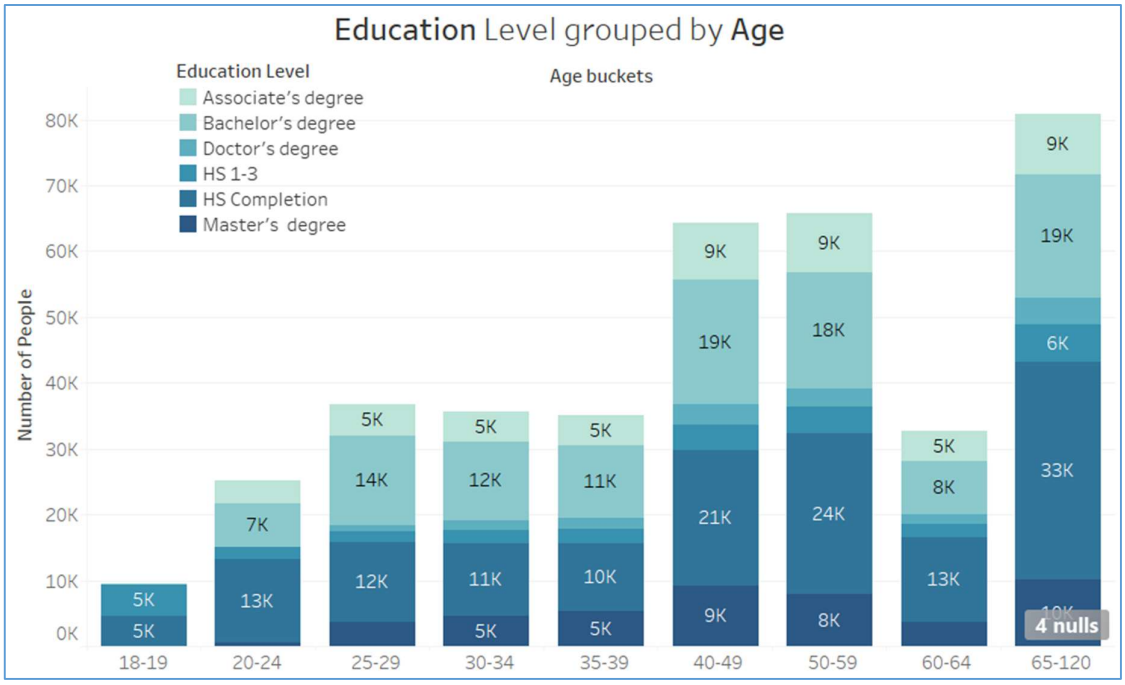


State Name	Avg. City Pop	Avg. Percent (%) of Labor Force Unem..	Avg. Median Income2019	Avg. Amt
Texas	289,987	6	67,900	72
California	192,618	7	85,200	73
New York	149,766	7	76,400	72
Florida	144,755	6	62,800	74
Indiana	142,595	6	61,000	68
Minnesota	99,309	5	79,100	68
Pennsylvania	92,974	6	67,300	72
Oklahoma	85,749	5	57,700	66
Alabama	84,854	7	54,800	65
Michigan	81,284	8	63,100	72
Missouri	65,803	6	60,800	69
Kentucky	58,930	7	55,400	67
Wisconsin	51,388	5	68,000	69
North Carolina	48,614	6	60,800	76
Virginia	39,784	5	81,000	70
New Jersey	28,116	6	90,900	66
Ohio	27,352	7	62,100	74
South Carolina	27,182	6	59,600	64
Georgia	24,775	6	65,700	70
Iowa	14,595	5	65,400	65
Nebraska	11,970	3	67,000	68
Maryland	10,078	5	91,900	65
Illinois	9,501	7	73,300	69
West Virginia	5,074	8	51,800	70
Arkansas	4,151	6	51,900	76
Grand Total	95,446	6	67,869	70

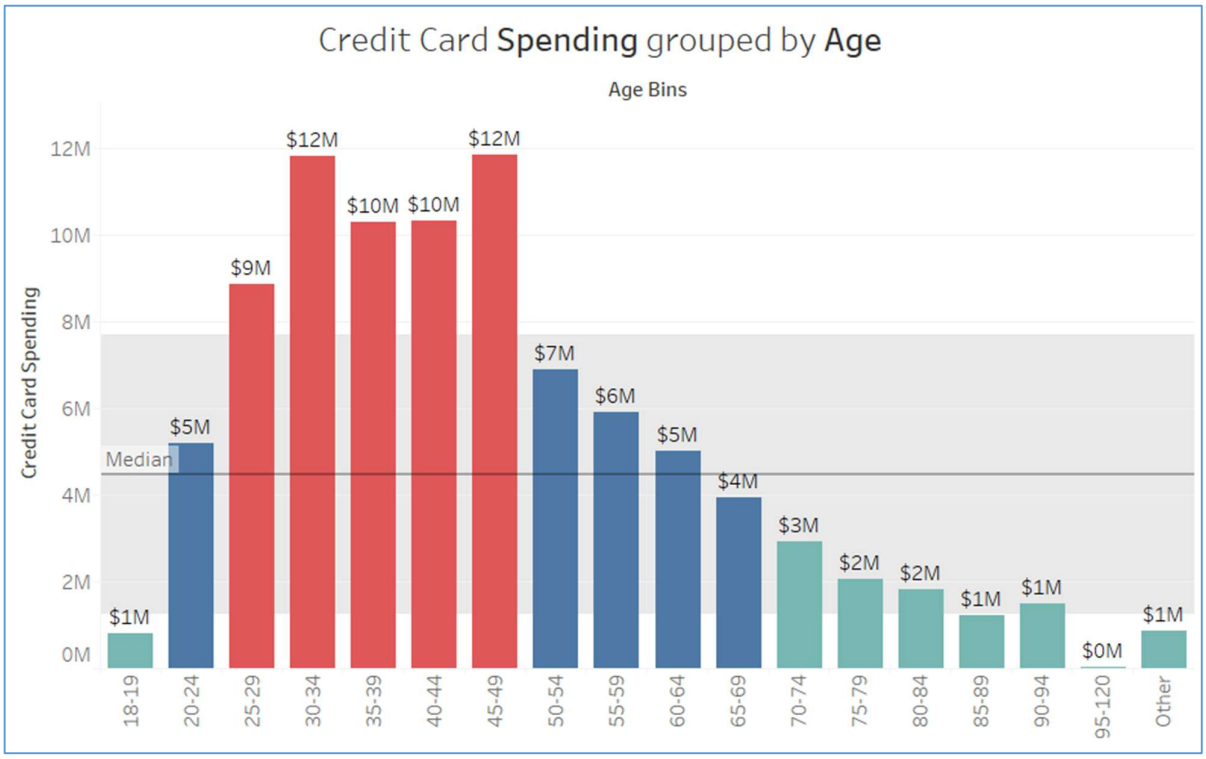
Graph 9- Anomaly in data: **Delaware**



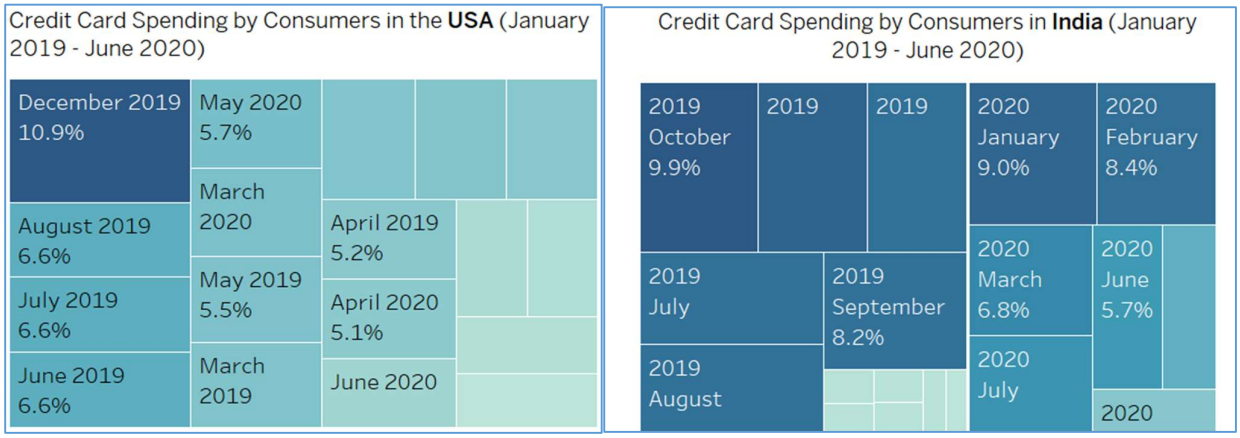
Graph 10- Stacked bar chart showing *"Number of people at different education levels by Age (2019)"*



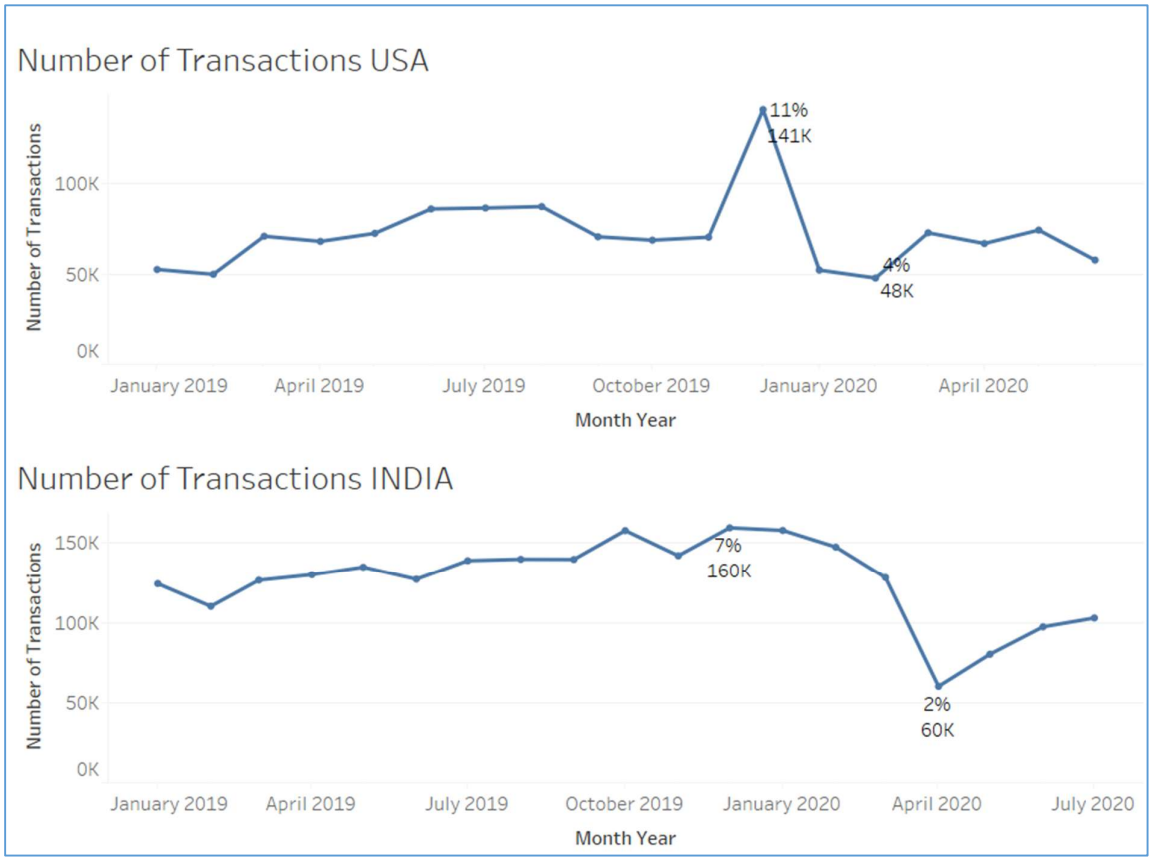
Graph 11- Bar chart showing *"Credit card spending amounts grouped by Age (2019)"*



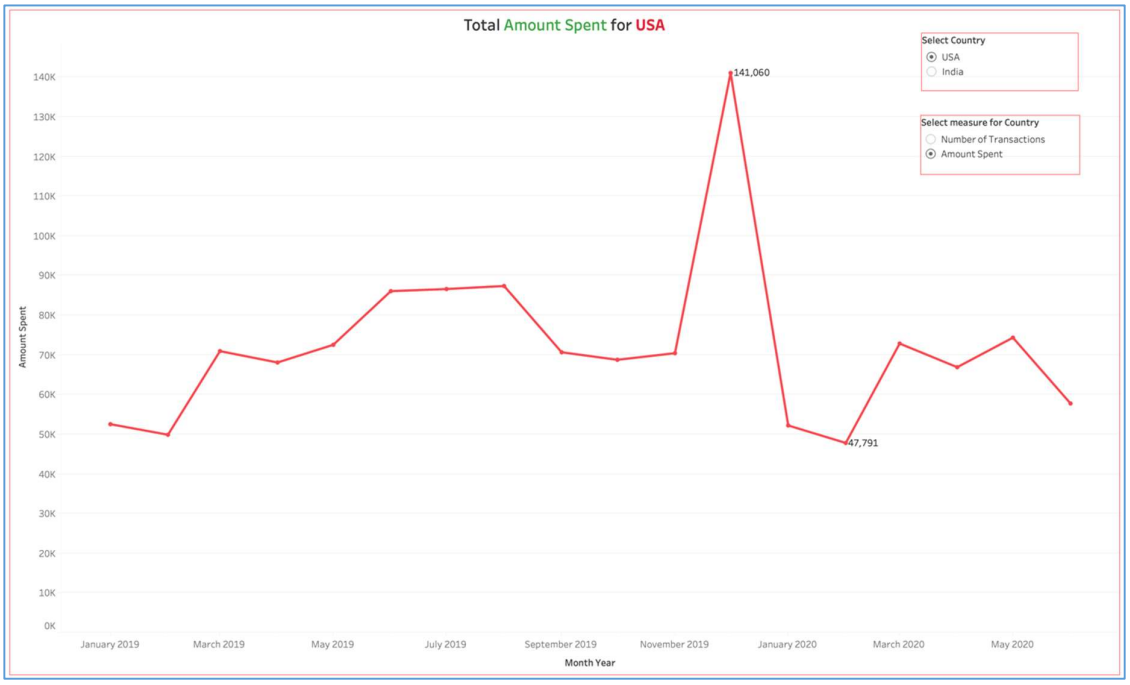
Graphs 12, 13- Tree maps showing *"Monthly Credit card spending amounts in US & India (2019-Jun'2020)"*



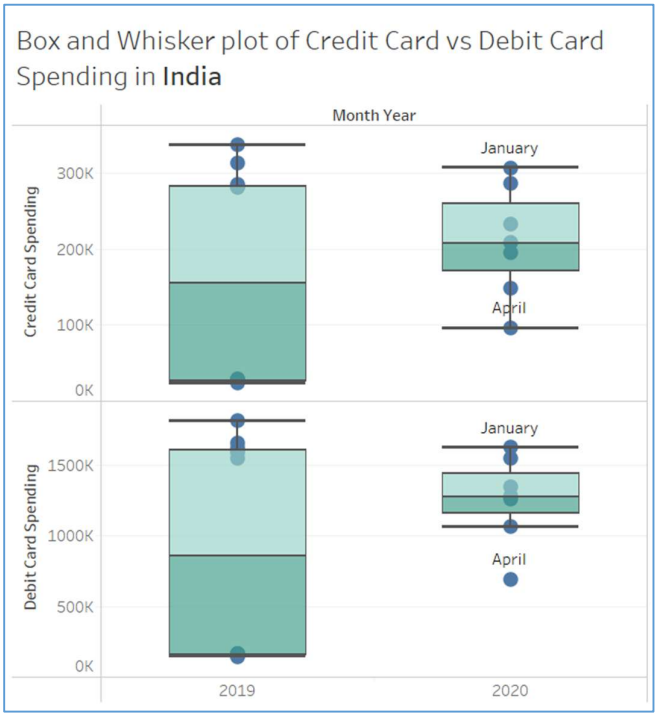
Graphs 14, 15- Line Chart showing *"Credit Card Transaction Volume in USA Vs India: A Trend in Usage Patterns (2019-June' 2020)"*



Graph 16- Line Chart showing *"Credit Card Transaction Volume & Amount in USA & India: A Trend in Usage Patterns (2019-June' 2020)"*



Graph 17- Box and Whisker Plot showing *"Distribution of Credit Card Vs Debit Card Spending in India (2019-June' 2020)"*



Graph 18- Line & Bar graph Combo chart showing *"Number of Credit Card Vs Debit Card transactions in India (2019-June' 2020)"*