

# ***IE 6600 - Computation and Data Visualization***



## ***Project 1 - Final Report*** ***Consumer Complaint Analysis***

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## Introduction

The Consumer Complaint Database, sourced from data.gov, serves as a comprehensive repository of consumer grievances related to various financial products and services. This invaluable dataset captures complaints sent to companies, shedding light on the interactions between consumers and financial entities. The dataset is meticulously maintained, with complaints being made public either upon the company's response, confirming a commercial relationship with the consumer, or after 15 days, depending on which comes first.

For the specific focus of our project, we have homed in on one prevalent financial product – Mortgage. This targeted approach allows us to delve into the intricate details of consumer complaints related to mortgages, offering a closer examination of the patterns and trends that emerge in the interactions between consumers and financial institutions.

Our dataset, meticulously filtered to encompass only Mortgage-related complaints, comprises a substantial 71,721 rows. Within this expansive dataset, we aim to uncover and analyze the nuances of companies' performance concerning consumer complaints in the mortgage sector. By scrutinizing the patterns and trends, we endeavor to provide valuable insights that can inform stakeholders, regulators, and the industry at large about the dynamics of consumer-company interactions within the mortgage landscape. This report stands as a comprehensive exploration of the Consumer Complaint Database, offering valuable perspectives on the performance of companies in addressing and responding to consumer concerns within the realm of mortgages.

Source: <https://catalog.data.gov/dataset/consumer-complaint-database>

# Dataset

## Row and Column Structure:

- The dataset consists of 71,720 entries and 18 columns, indicating a substantial amount of consumer complaint data.
- Each row represents a single consumer complaint lodged against a company.

Date received	Product	Sub-product	Issue	Sub-issue	Consumer complaint narrative	Company public response	Company	State	ZIP code	Tags	Consumer consent provided?	Submitted via	Date sent to company	Company response to consumer	Timely response?	Consumer dispute resolved?	Complaint ID	
6/13/23	Mortgage	Conventional	Struggling to pay	None		Company has responded	BANK OF AMERICA	FL	33483	None	N/A	Phone	6/13/23	Closed with consumer satisfaction	Yes	N/A	7111543	
4/13/23	Mortgage	Conventional	Struggling to pay	None	I am a XXXX	None	21ST MORTGAGE	IN	474XX	Servicemember	Consent provided	Web	5/18/23	Closed with consumer satisfaction	Yes	N/A	6834651	
9/20/23	Mortgage	Conventional	Applying for refinancing	Confusing or misleading	I was preapproved	None	NATIONS REALTY	KY	41018	None	Consent provided	Web	9/20/23	Closed with consumer satisfaction	No	N/A	7580627	
9/9/23	Mortgage	Conventional	Trouble during escrow	Payment problem	prolapsed	Company has responded	Freedom Mortgage	DC	20009	None	Consent provided	Web	9/9/23	Closed with consumer satisfaction	Yes	N/A	7524616	
11/6/23	Mortgage	Conventional	Trouble during escrow	taxes	Contacted mortgage servicer	Company has responded	SELECT PORTLAND	OR	38017	Older American	Consent provided	Web	11/6/23	Closed with consumer satisfaction	Yes	N/A	7806521	
1/12/23	Mortgage	Conventional	Trouble during escrow	None	After being	None	Rocket Mortgage	CA	XXXXX	Older American	Consent provided	Web	1/12/23	Closed with consumer satisfaction	Yes	N/A	6431206	
9/1/23	Mortgage	FHA	mortgage struggling to pay	An existing modification		Company has responded	Shellpoint Mortgage	MD	21001	None	Consent not provided	Web	9/1/23	Closed with consumer satisfaction	Yes	N/A	7481632	
2/8/23	Mortgage	FHA	mortgage struggling to pay	None		None	CARDINAL FINANCIAL	SD	57071	None	Consent not provided	Web	2/8/23	Closed with consumer satisfaction	Yes	N/A	6546134	
7/11/23	Mortgage	Conventional	Trouble during escrow	None		None	Mr. Cooper	CA	92020	Older American	Consent not provided	Web	7/11/23	Closed with consumer satisfaction	Yes	N/A	7236329	
11/3/21	Mortgage	Other type of mortgage	Struggling to pay	None		None	BCI FINANCIAL	FL	33310	None	Consent not provided	Web	11/3/21	Closed with consumer satisfaction	Yes	N/A	4872979	
7/17/23	Mortgage	FHA	mortgage incorrect information	Account info	In XXXX we	Company has responded	North Dakota	FL	344XX	Servicemember	Consent provided	Web	7/17/23	Closed with consumer satisfaction	Yes	N/A	7262289	
9/19/23	Mortgage	FHA	mortgage applying for refinancing	Fees or costs	My husband	Company has responded	LAKEVIEW	CO	80022	Servicemember	Consent provided	Web	9/19/23	Closed with consumer satisfaction	Yes	N/A	7566219	
4/14/22	Mortgage	Other type of mortgage	Applying for refinancing	None		None	Fay Servicing AL		36312	Older American	Consent not provided	Web	4/14/22	Closed with consumer satisfaction	Yes	N/A	5447771	
9/20/23	Mortgage	FHA	mortgage struggling to pay	Foreclosure		My attorney	None	Selene Holdri	CA	91709	None	Consent provided	Web	9/20/23	Closed with consumer satisfaction	Yes	N/A	7579779
12/7/22	Mortgage	Conventional	Trouble during escrow	None	Specialized	Company has responded	Specialized Lending	FL	33141	None	Consent provided	Web	12/7/22	Closed with consumer satisfaction	Yes	N/A	6292085	
2/13/23	Mortgage	Conventional	Trouble during escrow	None	I received the	None	CITIZENS FINANCIAL	TX	763XX	None	Consent provided	Web	2/13/23	Closed with consumer satisfaction	Yes	N/A	6566451	

## Column Information:

- Columns such as 'Product', 'Sub-product', 'Issue', and 'Sub-issue' provide detailed information about the nature of the complaints.
- 'Consumer complaint narrative' offers a narrative description provided by the consumer regarding the complaint.
- 'Company public response' records any public responses issued by the company regarding the complaints.
- 'Company' identifies the company against which the complaint was filed.
- 'State' and 'ZIP code' indicate the geographical location where the complaint originated.
- 'Tags' may include additional labels or categories associated with the complaints.
- 'Consumer consent provided?' indicates whether the consumer consented to share their complaint details.
- 'Submitted via' denotes the method through which the complaint was submitted.
- 'Date sent to company' records when the complaint was forwarded to the respective company.
- 'Company response to consumer' outlines the company's response to the consumer's complaint.
- 'Timely response?' indicates if the company responded to the complaint within a reasonable timeframe.

- 'Consumer disputed?' seems to track whether the consumer contested the resolution of the complaint, though all values are missing (NaN).
- 'Complaint ID' serves as a unique identifier for each complaint entry.

**Missing Data:**

- Several columns exhibit missing data, notably 'Sub-issue', 'Consumer complaint narrative', 'Company public response', 'State', 'ZIP code', 'Tags', 'Consumer consent provided?', and 'Company response to consumer'.
- The 'Consumer disputed?' column contains entirely missing values, indicating potential data collection issues or lack of information.

## Data Cleaning

Data cleaning is a crucial step in the process of preparing and analyzing a consumer compliance database. It involves identifying and rectifying errors, inconsistencies, and inaccuracies in the dataset to ensure its accuracy and reliability. Here are key steps in the data cleaning process for a consumer compliance database:

- **Missing Values:** Addressed the missing values by replacing it with 'Unknown' for categorical columns.

```
data.isnull().sum()
Date received      0
Product            0
Sub-product        0
Issue              0
Sub-issue          61839
Consumer complaint narrative 33907
Company public response 35610
Company            0
State              432
ZIP code           334
Tags               51999
Consumer consent provided? 14765
Submitted via      0
Date sent to company 0
Company response to consumer 1
Timely response?   0
Consumer disputed? 71720
Complaint ID       0
```

- **Duplicate Removal:** Eliminate duplicate records to maintain dataset integrity and prevent redundancy.

```
#Checking for duplicates
duplicate_rows = data[data.duplicated()]
# Display the duplicate rows
print("Duplicate Rows:")
print(duplicate_rows)

Duplicate Rows:
Empty DataFrame
```

- **Data Integrity Checks:** Validate overall dataset integrity, confirming logical relationships between variables and adherence to business rules.

```
data.drop(['Sub-issue', 'Company public response', 'ZIP code', 'Tags', 'Consumer disputed?'], axis=1, inplace=True)
```

- **Conditional Format:** Replacing Values of Column "Timely Response" with 1's and 0's

```
data['Timely response?'] = data['Timely response?'].replace({'Yes': 1, 'No': 0})
data.head()
```

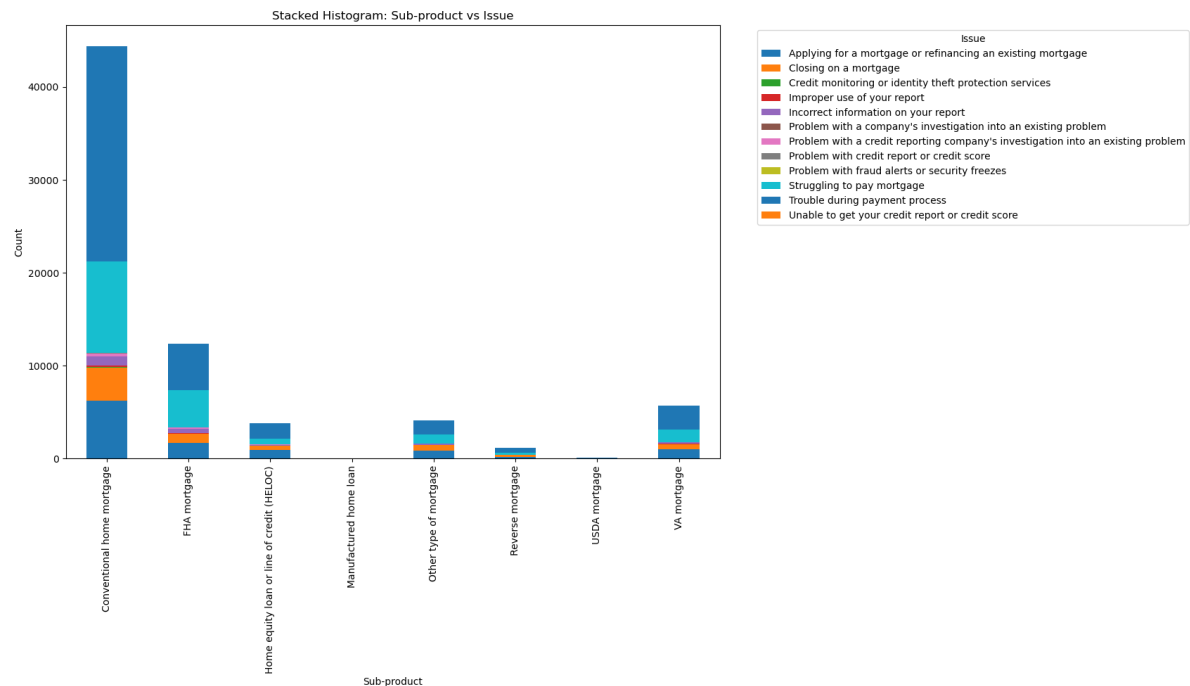
	Date received	Product	Sub-product	Issue	Consumer complaint narrative	Company	State	Consumer consent provided?	Submitted via	Date sent to company	Company response to consumer	Timely response?	Complaint ID
1	04/13/23	Mortgage	Conventional home mortgage	Struggling to pay mortgage	I am a XXXX XXXX XXXX XXXX veteran and I ...	21ST MORTGAGE CORP.	IN	Consent provided	Web	05/18/23	Closed with explanation	1	6834651
2	09/20/23	Mortgage	Conventional home mortgage	Applying for a mortgage or refinancing an exis...	I was preapproved for a conventional mortgage ...	NATIONS RELIABLE LENDING LLC	KY	Consent provided	Web	09/20/23	Closed with explanation	0	7580627
3	09/09/23	Mortgage	Conventional home mortgage	Trouble during payment process	I paid {\$100000.00} to Freedom Mortgage on XX/...	Freedom Mortgage Company	DC	Consent provided	Web	09/09/23	Closed with explanation	1	7524616
4	11/06/23	Mortgage	Conventional home mortgage	Trouble during payment process	Contacted mortgage servicer XX/XX/2023 to requ...	SELECT PORTFOLIO SERVICING, INC.	TN	Consent provided	Web	11/06/23	Closed with explanation	1	7806521
5	01/12/23	Mortgage	Conventional home mortgage	Trouble during payment process	After being told by Rocket Mortgage 's " Custo...	Rocket Mortgage, LLC	CA	Consent provided	Web	01/12/23	Closed with explanation	1	6431206

*Cleaned Dataset*

# Data Visualization

- Stacked Histogram of Sub-Product vs Issue:

The primary concern within the Mortgage sub-product is related to Conventional home loans, where individuals are struggling to make mortgage payments. This difficulty is potentially linked to the substantial ticket size of home loans and the associated monthly EMIs.



- Waffle Chart displaying the count of Submitted-via:

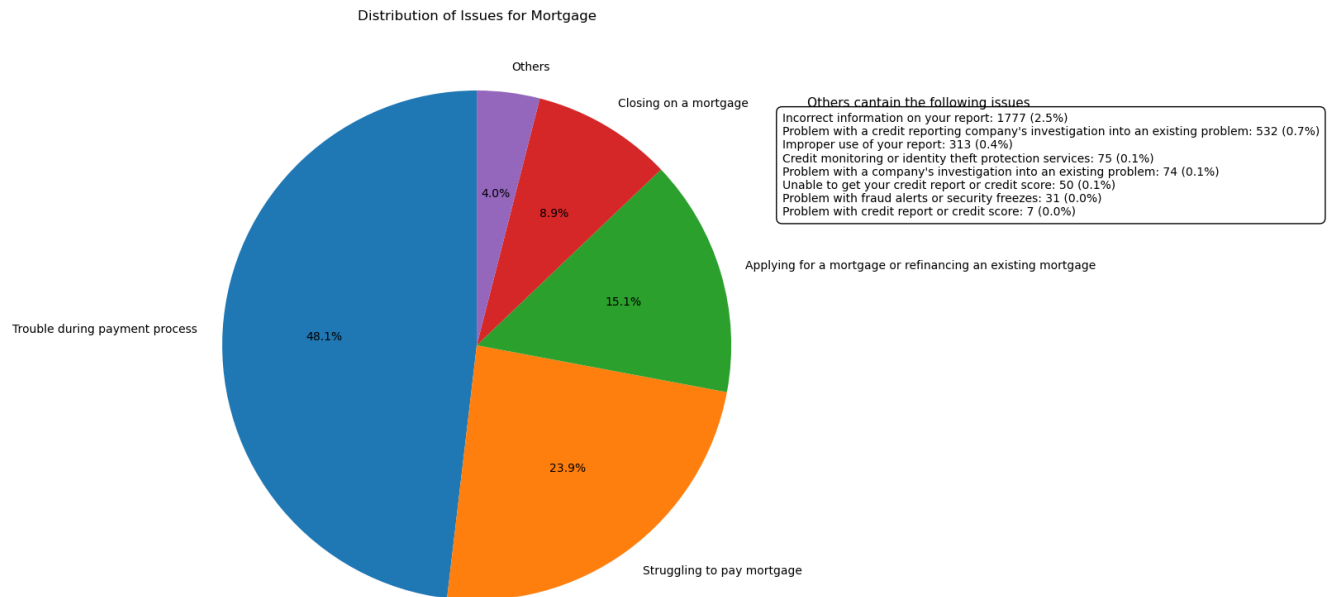
The graph illustrates the overwhelming dominance of web-based applications for customer support, particularly evident in the banking sector where all institutions have embraced digital means of assistance. Additionally, the second most prominent medium for customer support across these banks is through phone-based services.





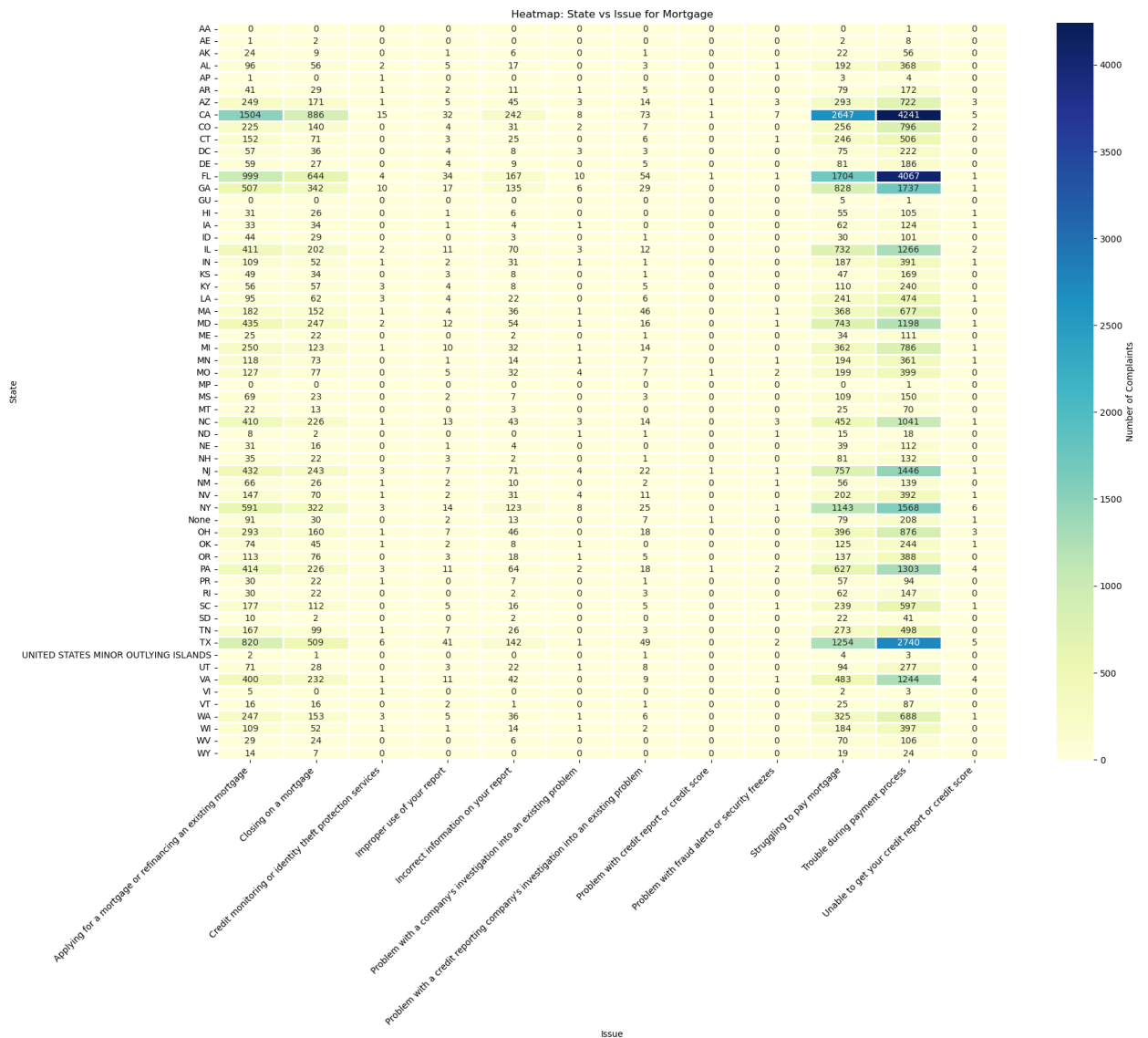
- **Pie chart distribution of the Issues for Product Mortgage:**

The pie chart represents the distribution of issues for the product Mortgage. We can observe that ‘Trouble during payment process’ is the major issue for the Mortgage product with ‘Struggling to pay mortgage’ coming in a close second place. The ‘Others’ consists of a bunch of issues as mentioned in the legend and these issues have a portion share of <2.5%.



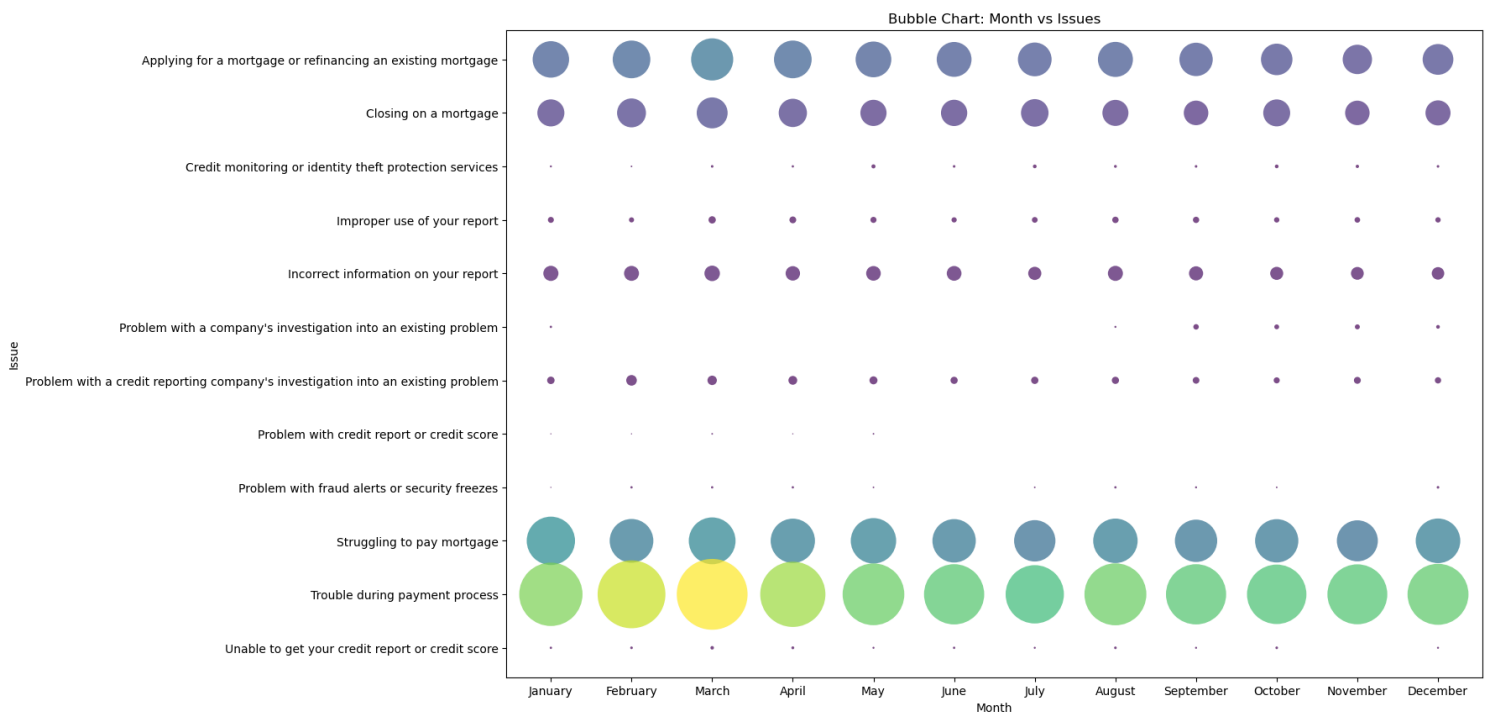
- Heatmap of State vs Issue for Product Mortgage:

The heatmap displays the distribution of issues across different states with their intensity marked on the spectrum. ‘Trouble during payment process’ tops the issues and shows the highest concentration throughout and ‘Struggling to pay mortgage’ shows the second highest concentration. It can be observed that California (CA) has the highest concentration of ‘Trouble during payment process’ with a concentration of 4241 issues whereas Florida (FL) has a concentration of 4067 issues. The next heavily concentrated issue is that of ‘Struggling to pay mortgage’ with CA and FL having a concentration of 2647 and 1704 issues each. Texas (TX) comes in third place with a concentration of 2740 and 1254 issues respectively of the top two issues.



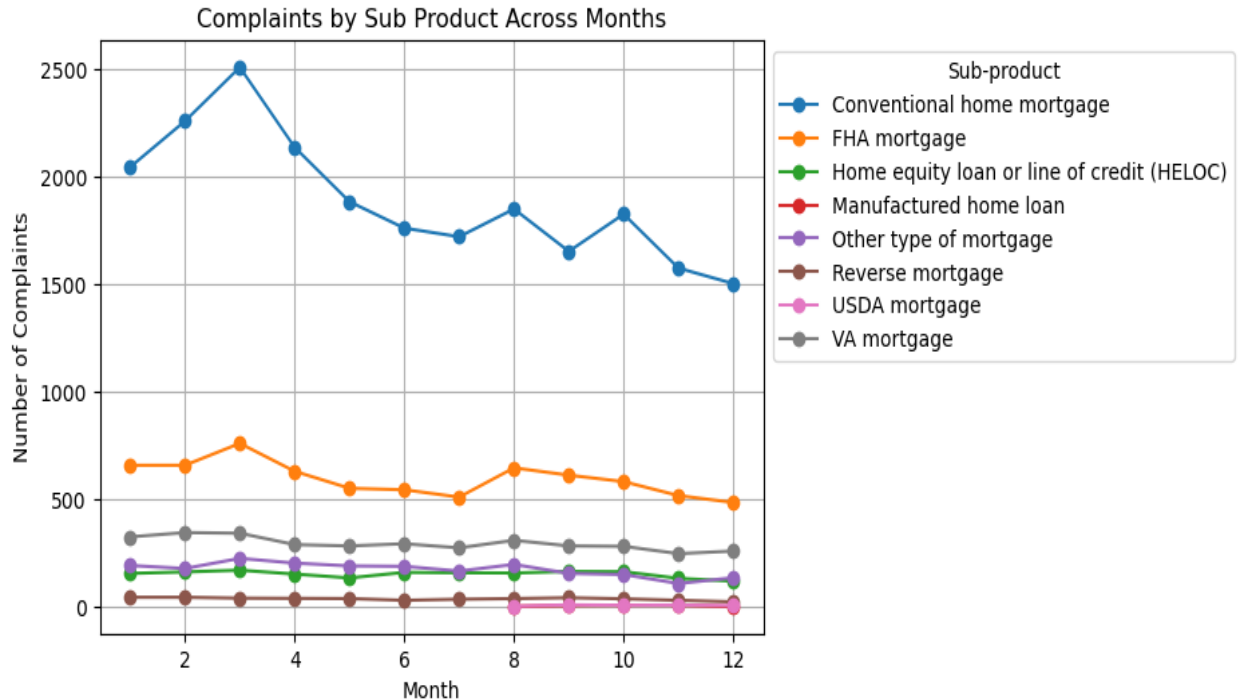
- **Bubble Chart of Month vs Issue for Product Mortgage:**

The bubble chart displays the distribution of issues across the months of the year. ‘Trouble during payment process’ shows the highest concentration throughout the year with the biggest bubbles demonstrated. But it specifically tops during the March month, due to the possible ending of the financial year. Few of the issues show negligible concentration due to being overshadowed by the heavy concentrations of others. But almost all of them have their highest concentrations around March.



- **Time Series Graph:**

The depicted time series graph illustrates the fluctuation in the number of complaints across various Sub-Products throughout the year. Notably, Sub-Products such as Conventional Home Mortgage and FHA Mortgage experienced a significant surge in complaints, particularly in March. Conversely, the data reveals a decline in complaints across all Sub-Product types during December. This temporal pattern provides insights into the dynamics of consumer complaints, highlighting specific months that warrant closer examination for potential factors influencing complaint volumes.



## Statistical Analysis

Employing fundamental statistical methods, our study aimed to assess the efficacy of companies in handling consumer complaints. Notably, Wells Fargo & Company emerged as the leading performer, demonstrating an exemplary record with zero instances of 'No' Timely Response. In contrast, Bank of America, National Association surfaced as the company with the lowest resolved complaints relative to its counterparts.

This analysis serves as a valuable tool for companies seeking to enhance their consumer management processes and operational efficiency. By identifying top performers and areas for improvement, organizations can strategically refine their approaches to better address and resolve consumer complaints, ultimately fostering a more robust and consumer-friendly business environment.

Company	Number of Issues	Count of Timely Response 0	% Distribution of Issues
WELLS FARGO & COMPANY	2982	0	0.0
Mr. Cooper Group Inc.	2787	1	0.04
Shellpoint Partners, LLC	2068	3	0.15
Ocwen Financial Corporation	1598	0	0.0
SELECT PORTFOLIO SERVICING, INC.	1506	2	0.13
Freedom Mortgage Company	1439	0	0.0
LoanCare, LLC	1196	20	1.67
Specialized Loan Servicing Holdings LLC	1138	6	0.53
BANK OF AMERICA, NATIONAL ASSOCIATION	1015	3	0.3

## Conclusion

- **Consumer Complaint Database Overview:**
  - A comprehensive collection of consumer complaints on financial products.
  - Focus on Mortgage-related complaints with a dataset size of 71,721 rows and 18 columns.
- **Challenges in Conventional Home loans:**
  - Highest Issues identified in Sub-product - Conventional Home loans.
  - The main reason is struggling to pay the mortgage, possibly due to loan size and their monthly payments.
- **Digital Transformation in Banking:**
  - The dominance of Web-Based Applications is showcased.
  - All banks embrace digital channels for customer support, with phone support as the second-largest medium.
- **Temporal Trends in Complaints:**
  - March sees a notable surge in complaints for Home Loans and FHA Mortgages.
  - December records minimal complaints across various sub-products.
- **Company Performance Analysis:**
  - Fundamental statistical methods used to evaluate companies in handling complaints.
  - Wells Fargo & Company excels with a flawless record of timely responses, while Bank of America, National Association, identifies areas for improvement in complaint resolution.

## References

- <https://catalog.data.gov/dataset/consumer-complaint-database>
- <https://pandas.pydata.org/>
- <https://www.machinelearningplus.com/plots/top-50-matplotlib-visualizations-the-master-plots-python/>
- <https://www.consumerfinance.gov/data-research/consumer-complaints/>