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**ANALYSIS ON T-MOBILE**

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# **Company Overview**

T-Mobile is known as America’s Un-carrier, which provides high speed 4G LTE mobile network and high-speed fiber optic connections across the country to household and cooperates. T-Mobile has seen various changes in recent years, one of which is that the "Uncarrier" has broadened its customer base beyond consumers. The company operates in Europe, but its main market is United States with 109M customers reported in March’2022. Deutsche Telekom owns the majority stakes in T-Mobile which is 46%, and the soft bank owns the 4.6% of T-Mobile’s equity. The company has continuously grown its market share quarter over quarter, currently being at 24.9% and has also gained two-digit growth rate over last year. T-Mobile’s operating revenue for 2021 was reported as 80 billion while 2020 was 61.7 billion. Adding to this growth rate, T-Mobile is constantly acquiring and partnering with emerging companies and one of the recent acquisitions was of Sprint carrier. They acquired Sprint in a $26B all shares transaction and completed merger on April 1, 2020.

On the service side, company is customer centric where they not only provide high data but also at cheapest price in the industry. Customers benefit from the Un-unrivalled carrier's mix of pricing and quality, unrelenting commitment to providing them with the greatest possible service experience, and undeniable will to disrupt the cellular industry and beyond. They also use different social media platforms for their marketing and promotions. The company has highest tweets on twitter when compared to their competitors such as AT&T and Verizon which are other two players in telecom industry. With 550k tweets wins the customer engagement race, while AT&T has 198k and Verizon lack with just 49k tweets.

Communication service providers can be considered as among the world’s biggest aggregators of consumer data and already have access to vast amounts of valuable data including detailed customer profiles, content preferences, usage patterns to device, network, location, sensor, and application usage data. Besides using this data to analyze churn, perform targeted marketing, identify fraud, optimize networks, T-Mobile also used data to enhance the end-to-end customer experience, create real-time targeted marketing and promotions, enable predictive maintenance to proactively fix issues and monetize 5G. Recently, T-Mobile has also actively leveraged their rich data analytics capabilities to perform customer footfall analytics which retail chains use to identify who is visiting the stores and when, traffic patterns and bottlenecks to help logistics companies fine-tune their delivery processes and run targeted campaign and advertising data for advertising agencies targeting specific micro segments.

To further their data analytical efforts, T-Mobile has been actively partnering with more and more companies like Gravy Analytics, StatSocial, V12 Data, Adobe Marketing Cloud, Equifax, Data Axle and till now has parented with around 88 data or analytics companies.

# Twitter Data Overview, Analysis, Observation, and Conclusions

To perform analysis, we used data from twitter by scraping the tweets of T-Mobile, AT&T, and Verizon of approximately 5 months i.e., 3250 records each.

## Data Overview

To perform our analysis, we scrapped twitter data of T-Mobile as well its main competitors such as AT&T and Verizon. To do this, we first consume the tweet data using the twitter APIs followed by cleaning the data by identifying the important variables, handling the null values in those variables, and then adding important flag variables in the data to conduct our analysis.

After scrapping the data, the original data set had about 90 variables of which only 24 variables were useful for our analysis. These 24 variables included data points related to tweets such as Tweet URL, Actual Tweet, Hashtag Used, Media Used and much more. In addition to these 24 variables, we added 3 more variables namely ‘Has\_Hashtag’ which told us whether the tweet included a hashtag or not, ‘Has-Mention’ which told us whether the tweet included a mention or not, and most important ‘Tweet\_Category’ which told us whether the tweet was an ‘Original Tweet’, ‘Reply’ or ‘Retweet’.

* **Tweet Categorization**

The pseudo logic for the tweet categorization was as follows:

*Loop {*

*If (Retweet Flag is equal to 1) then {Tweet is a ‘Retweet’}*

*else if (Tweet includes a Reply Id) then {Tweet is a ‘Reply’}*

*else {Tweet is an Original ‘Tweet’}*

*}*

* **Has\_Hashtag Flag**

The pseudo logic for the Has\_Hashtag Flag was as follows:

*Loop {*

*If (Tweet includes Hastag) then {Has\_Hashtag flag is 1}*

*else {Has\_Hashtag flag is 0}*

*}*

* **Has\_Mention Flag**

The pseudo logic for the Has\_Mention Flag was as follows:

*Loop {*

*If (Tweet includes Mention) then {Has\_Mention flag is 1}*

*else {Has\_Mention flag is 0}*

*}*

## Data Analysis

With the twitter data in place with the required cleaning and additional variables, we performed a rigorous analysis of the tweets to extrapolate answers to the following questions:

* What is T-Mobile been up to on twitter during the last 5 months?
* How many times has T-Mobile tweeted over the last 5 months?
* Of these tweets, how many included videos or images?
* Of these tweets, how many included hashtags or mentions?
* How many average likes did the T-Mobile tweets receive over the last 5 months for the different categories such as:
  + **Original Tweets** – Text only, Includes Video, Includes Hashtag, Includes Mention
  + **Replies** - Text only, Includes Video, Includes Hashtag, Includes Mention
* Where does T-Mobile stand when compared to its competitors based on average likes per tweet along the different categories and sub-categories.

To perform this analysis, we used multiple for loops and nested if else in R to determine the total number of original tweets made by T-Mobile which included Photo, Only Text, at least 1 Hashtag, and At least 1 Mention and then calculated the average number of likes T-Mobile receive per tweet for each of these categories. Of 3250 tweets from T-Mobile:

* **3133** were replies
  + **67** included a photo or video
  + **3066** included only text
  + **357** included at least one hashtag
  + **3082** included at least one mention
* **108** were original tweets
  + **52** included a photo or video
  + **56** included only text
  + **55** included at least one hashtag
  + **30** included at least one mention

Furthermore, the average number of likes of the original tweets for the categories i.e., includes a photo or video, includes only text, includes at least one hashtag, includes at least one mention was 1618, 450, 1444, and 1953 respectively.

## Observations & Conclusions

The interesting observation here was that when compared to its competitors Verizon and AT&T for the same duration and almost identical number of tweets even along different categories, T-Mobile performed way better than its competitors and below is the summary of the performance.

We noticed that the average number of likes on the original tweets of T-Mobile for tweets which included mentions were highest with 1953 likes, followed by tweets which included photo with 1618 likes, followed by tweets which included hashtags with 1444 likes and finally tweets which included text with 450 average likes per tweet.

The T-Mobile average likes per tweet for tweets which include Photo were 20 times more v/s ATT and 10 times more v/s Verizon, for tweets with only text were 10 times more v/s ATT 4 times more v/s Verizon, for tweets that include Hashtag were 2.5 times more v/s ATT 8 times more v/s Verizon, and for tweets which include Mentions were 19 times more v/s ATT 10 times more v/s Verizon.

# Revenue & Stock Data Overview, Analysis, Observation, and Conclusions

## Data Overview

The data we collected includes the last 10 year 10-K Filings of T-Mobile and the historical data of T-Mobile over a year (April 2021 to April 2022) from Yahoo Finance. As we can see, from these data sources we can retrieve the Sales revenue of T-Mobile and everyday closing price of T-Mobile as datapoints over a period as a sequence of time gap. Both these data are time series data and time series analysis must be conducted on them to predict or forecast any future value.

## Data Analysis

We chose ARIMA model as our model to forecast the future of T-Mobile with respect to Sales Revenue and Stock Price. ARIMA stands for Auto-Regressive Integrated Moving Average. It works based on the statistical concept of serial correlation where the current data points are influenced by the historical data points. The two assumptions made while using ARIMA as our model are:

* **Data is stationary**

The data points are different, but the behavior of data is constant.

* **Data is univariate**

Only one variable is considered, and regression is with its past values. In our project, in Sales Revenue forecasting, the variable is sales revenue (operational revenue) from 10-K and in Stock price forecasting, the variable is closing price. ARIMA involves Auto-regressive component, Integrator, moving average component.

* **Auto-Regression (AR)**

A value of a variable that is regressed from its own previous value.

* **Integrator (I)**

The data points are replaced by the differences between data points and their previous values. This is the component that makes the data stationary.

* **Moving Average (MA)**

This operates under the criteria that the current deviation of data points from its mean depends on its previous deviations. Moving average is applied on regressed data points.

The three parameters of ARIMA model are p, d and q.

p: Number of lags; Known as lag order

d: Number of times data points are differenced; Known as degree of differencing

q: Size of moving window; Known as order of moving average.

The values of p, d and q are usually determined based on ACF/PACF plots. Different values can be used to compare the results of the model. When auto.arima() is used, the model tends to pick the values that fit the data points well and thus results in the fittest model.

## Observations & Conclusions

The forecast library in R is used in both Sales Revenue forecasting and Stock Price forecasting. In Sales Revenue forecasting, we used only auto.arima(). While fit <- auto.arima(mts) picks applies the fittest ARIMA model on data (mts), forecast(fit,5) helps in forecasting the Sales Revenue of next 5 years based on that model. This simple code helped us forecast the sales revenue of TMobile for the next 5 years (2022 to 2026) based on the sales revenue of the last 10 years (2011 to 2021). The variable considered in this case is the Operating revenue of TMobile.

In Stock Price forecasting, we used both arima(2,0,2) and auto.arima(). We did the stock price forecasting in two phases. Firstly, we retrieved only the closing price of each day over the year as our data points. The only variable in this case is the closing price. We applied residual plot, ACF and PACF functions on it.

ACF is an auto-correlation function that gives auto-correlation values of any series with its lagged values. PACF is a partial auto-correlation function. It finds the correlation of the residuals with its next lag value. As discussed earlier, p, d and f values were chosen as (2, 0, 2) as suggested by the ACF plot. The actual series is considered from Jan 1st, 2022, and the forecasted series follows it. The accuracy achieved by this model is 44.445%

A forecasting model is good for use if the accuracy % is greater than 50. So, to improve the accuracy, we used auto.arima(). While auto.arima() put the fittest model to work, the accuracy achieved is 55.556%.

1. SALES REVENUE VISUALIZATIONS
   1. Sales revenue – HISTORICAL DATA (2011 TO 2021)

Chart, line chart

Description automatically generated

* 1. Sales revenue FORECASTING (2022 TO 2026)

Chart, line chart

Description automatically generated

1. STOCK PRICE VISUALIZATIONS
   1. Arima forecast (using 2,0,2)
      1. Log Return Plot

Chart, line chart

Description automatically generated

* + 1. ACF Plot

Chart

Description automatically generated

* + 1. PACF Plot

Chart

Description automatically generated

* + 1. Residual Plot

Chart

Description automatically generated

* + 1. Arima forecast

Chart, line chart

Description automatically generated

* + 1. Actual Returns vs Forecasted Returns

Chart, line chart

Description automatically generated

* 1. Arima forecast (using auto Arima)
     1. Arima Forecast

Chart, line chart

Description automatically generated

* + 1. Actual vs Forecasted Returns using auto arima

Chart, line chart

Description automatically generated

# Exhibits



# References

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