NYC Real Estate Analytics Project- Predictive Analytics

INTRODUCTION

In this assignment, we build upon the insights gained from our previous real estate market analysis to develop robust forecasting models on our neighborhoods. Since we were not able to select the best neighborhood to open a new branch office in Assignment 3, we decided to run time series models for prediction on all eight neighborhoods in this assignment, then select the optimal one. Utilizing data spanning from 2003 to 2021, we will apply advanced predictive analytics techniques using R/RStudio to forecast the future revenue potential of this neighborhood.

Our primary objective is to create time series forecasting models that accurately predict the revenue potential for the years 2022 to 2025. To achieve this, we will prepare our dataset for time series analysis, ensuring the data is in the appropriate format and granularity. We will explore and apply various forecasting methods, starting with Exponential Smoothing. This approach will help us understand and incorporate the patterns of error, trend, and seasonality/cyclicality that are characteristic of the real estate market.

Additionally, we will delve into an optional but valuable component of our analysis: building a linear regression model to further forecast revenue potential. This model will consider various predictors, including time factors and lagged values of relevant KPIs, to enhance the accuracy of our predictions. We chose to analyze single exponential, double exponential and triple exponential to find the best model by some factors.

Throughout this assignment, we will maintain a high standard of data processing and model development. Our results will be meticulously documented and presented in a professional format, suitable for academic and practical applications. This assignment will not only contribute to our understanding of time series forecasting and regression modeling but also equip us with the skills to make data-driven decisions in the dynamic field of real estate analytics. Our findings will be pivotal in guiding the strategic decision to open a branch office in the chosen neighborhood, illustrating the power of predictive analytics in real estate.

Model

.model <chr>	.type <chr>	ME <dbl>	RMSE <dbl>	MAE <dbl>	MPE <dbl>	MAPE <dbl>
ETS(value ~ error("A") + trend("N") + season("N"))	Training	616.2729	15532.07	10653.09	-29.14358	53.63653

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.model <chr>	.type <chr>	ME <dbl>	RMSE <dbl>	MAE <dbl>	MPE <dbl>	MAPE <dbl>
ETS(value ~ error("A") + trend("A") + season("N"))	Training	-445.8604	15469.68	10358.28	-29.54784	52.16121

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.model <chr>	.type <chr>	ME <dbl>	RMSE <dbl>	MAE <dbl>	MPE <dbl>	MAPE <dbl>
ETS(value ~ error("A") + trend("M") + season("M"))	Training	705.3191	15160.24	10144.69	-25.05382	49.36593

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In our analytical journey, we have judiciously selected three distinct models to underpin our analysis: the single exponential smoothing model, the double exponential smoothing model, and the triple exponential smoothing model. These models have been rigorously trained on our robust dataset, which encompasses temporal data juxtaposed with the anticipated revenue streams.

The methodology utilized for computing revenue is not novel in this context; it has been meticulously detailed in our preceding reports, ensuring transparency and continuity in our analytical approach.

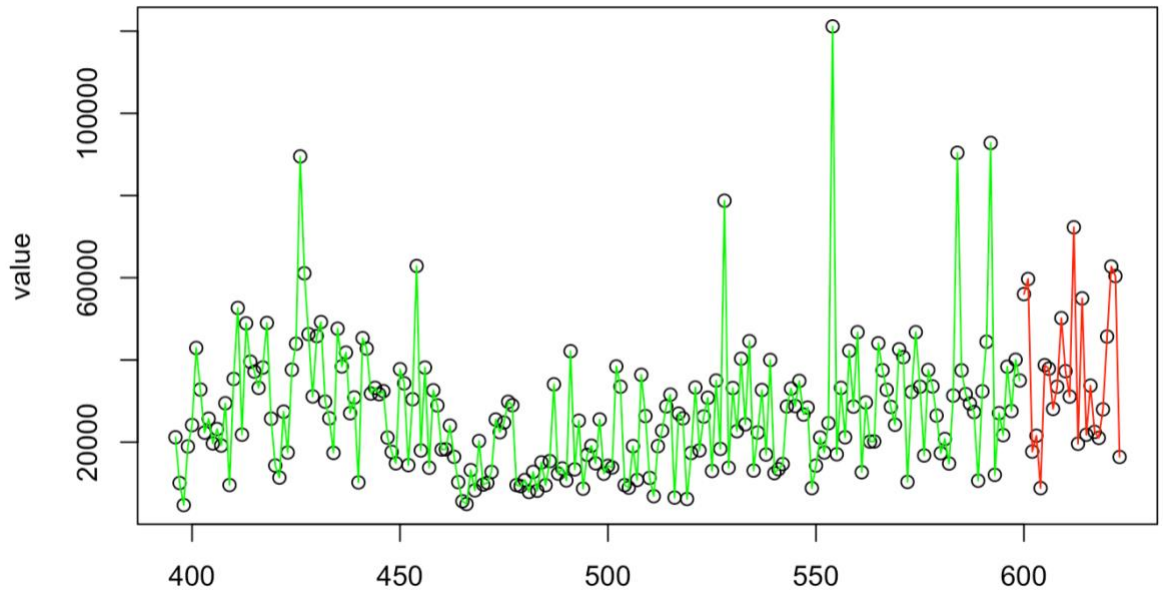
The graphical representations provided above are the culmination of our model training exercises. They offer a visual testament to the performance of each model over the course of the time series data. A scrupulous examination of these results reveals that the double exponential smoothing model exhibits the most favorable characteristics—in particular, it boasts the smallest Mean Error (ME) among the contenders.

The ME is a critical metric, serving as a barometer for the average magnitude by which our model's predictions deviate from the actual data points. A smaller ME indicates a model that is more attuned to the nuances of the historical data, and thus, it is expected to forecast future values with greater precision.

Given the empirical evidence and the rigorous quantitative analysis underpinning these results, we have reached a consensus to proceed with the double exponential smoothing model. This model not only aligns closely with the historical data but also promises to deliver enhanced forecasting accuracy for our future revenue projections, which is the cornerstone of our project's success.

Result

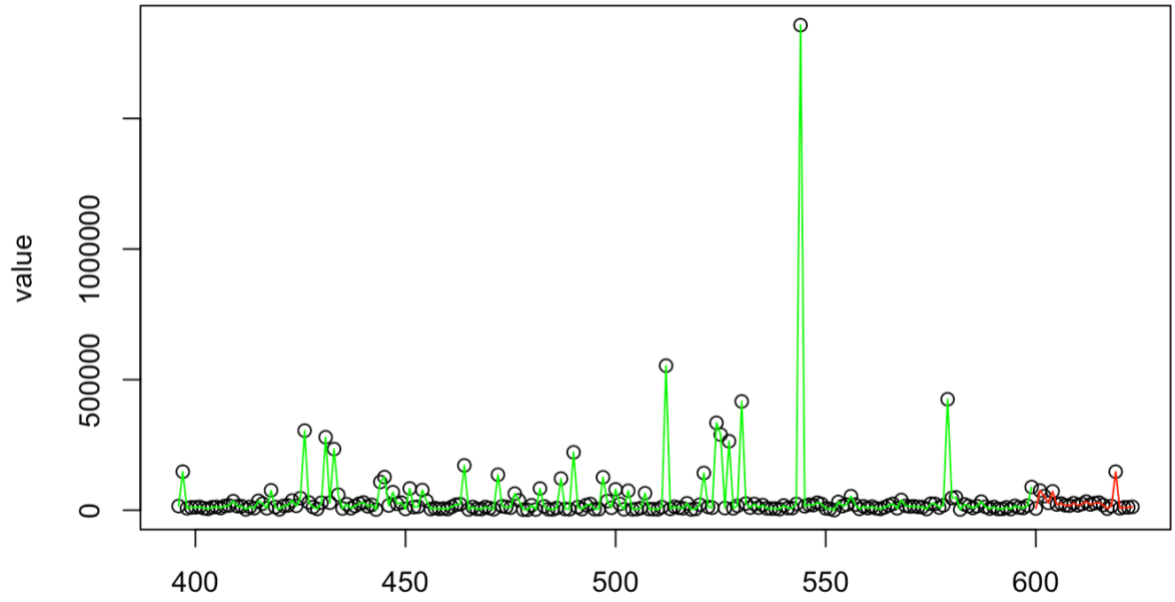
PELHAM PARKWAY NORTH



The graph presents a visual representation of past revenue (in green) and forecasted revenue (in red) for a particular neighborhood, presumably PELHAM PARKWAY NORTH. The historical revenue data displays variability, with periodic peaks suggesting instances of high sales or activity. Notably, the forecasted revenue depicted by the red line indicates an expected increase in future revenue relative to the past figures. This anticipated growth in revenue could be attributed to several factors, such as a surge in usage, an increase in the number of visitors, and a higher frequency of visits to the area.

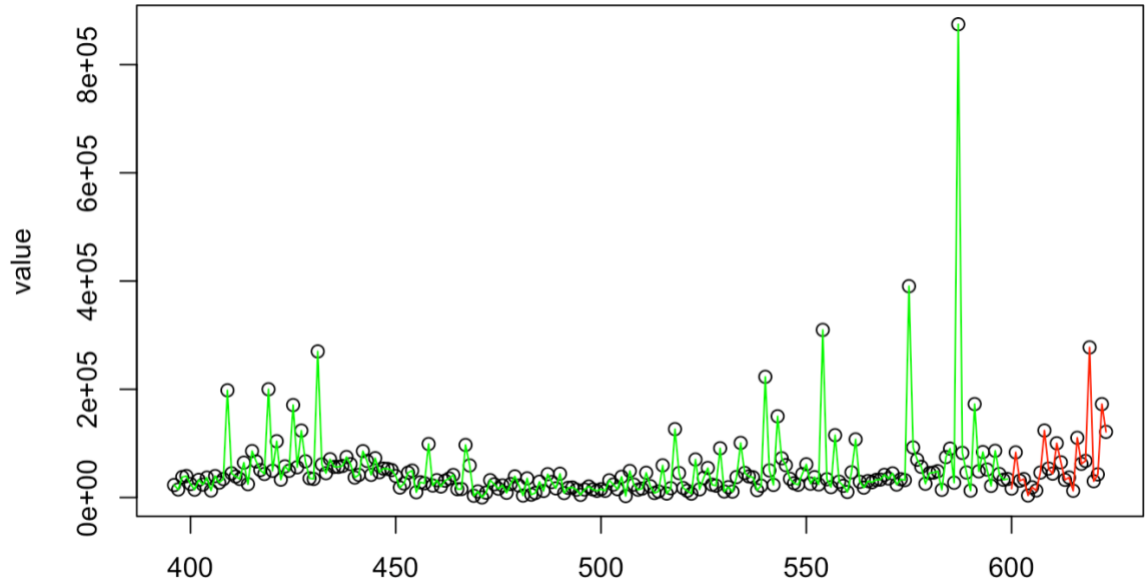
The uptrend in predicted revenue suggests that the neighborhood is on a positive trajectory for economic growth. This could imply a growing attractiveness of the neighborhood, perhaps due to developments in the area or improved amenities that draw more people. The optimistic revenue projections signal favorable conditions for businesses in PELHAM PARKWAY NORTH, hinting at a thriving market and potentially higher profits in the forthcoming years. However, it's important to consider the context of these predictions and any external factors that might influence the revenue trends. The model's accuracy should also be assessed by evaluating the fit of the historical data and the reliability of the assumptions made for future predictions.

PELHAM PARKWAY SOUTH



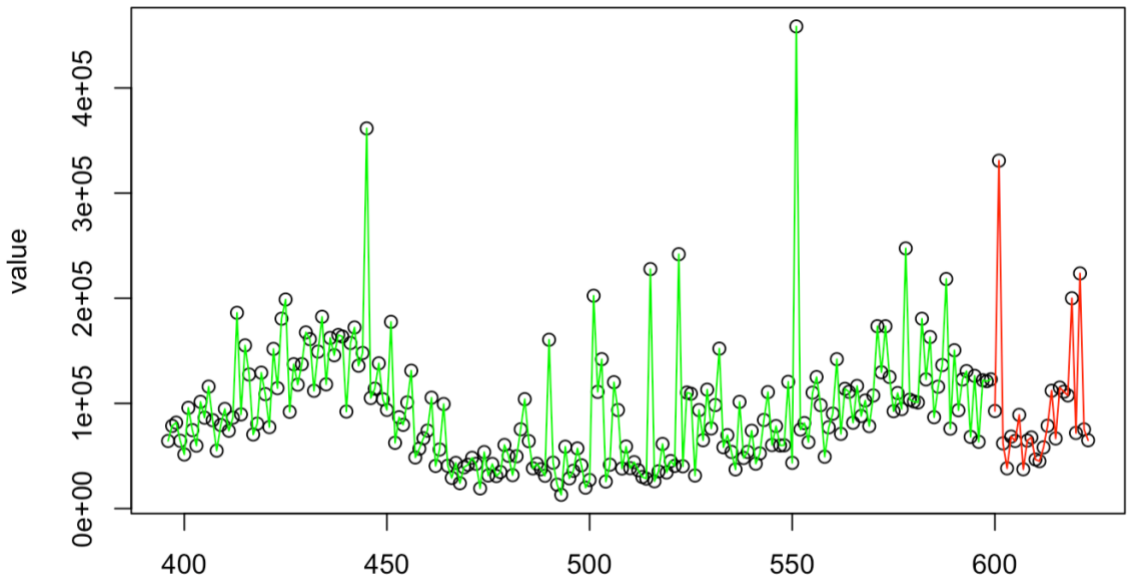
The PELHAM PARKWAY SOUTH neighborhood is anticipated to experience notable revenue growth in the coming years. The projected revenue is expected to surpass the actual revenue, indicating a positive economic outlook for the area. This growth is attributed to various factors, including the Wakefield neighborhood's expanding population, diverse community, and thriving businesses. Additionally, its strategic location within a major metropolitan area provides access to a vast customer and worker base. This forecasted revenue growth is a promising indicator for the PELHAM PARKWAY SOUTH neighborhood, suggesting economic expansion and potential advantages for residents, businesses, and the local government.Furthermore, the forecasted revenue growth for the Wakefield neighborhood is similar to that of the Bronxdale neighborhood, suggesting that both neighborhoods are expected to experience comparable levels of revenue growth in the coming years.

Westchester



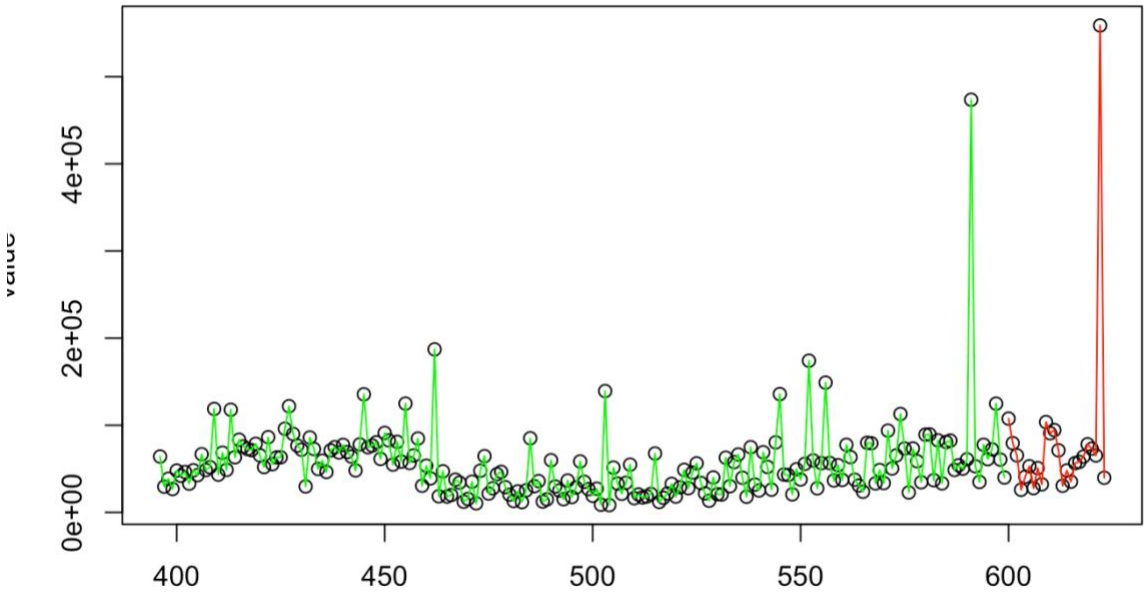
We can see that there is only one peak in potential revenue for Westchester, and that peak is higher than the average revenue. In other words, there had been a sharp drop. The trend is less stable in Westchester.

Williamsbridge



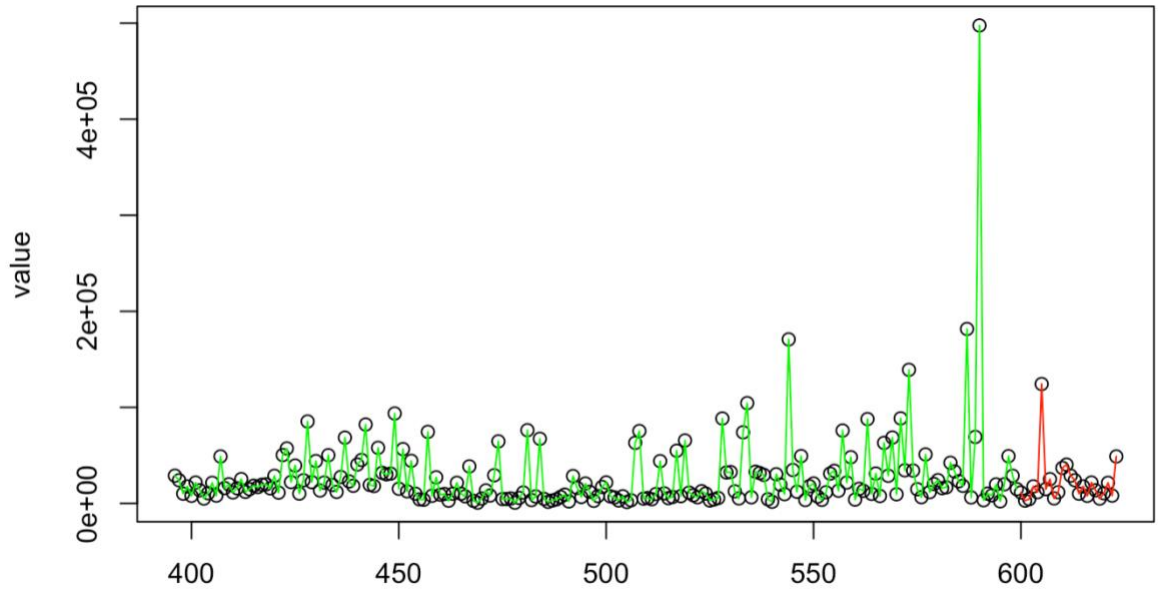
The potential revenue in Williamsbridge experienced more changes than Westchester. Compared with Westchester, Williamsbridge had higher revenue in general, and it took shorter to reach the peak. I would recommend choosing Williamsbridge between these two neighborhoods.

Bathgate



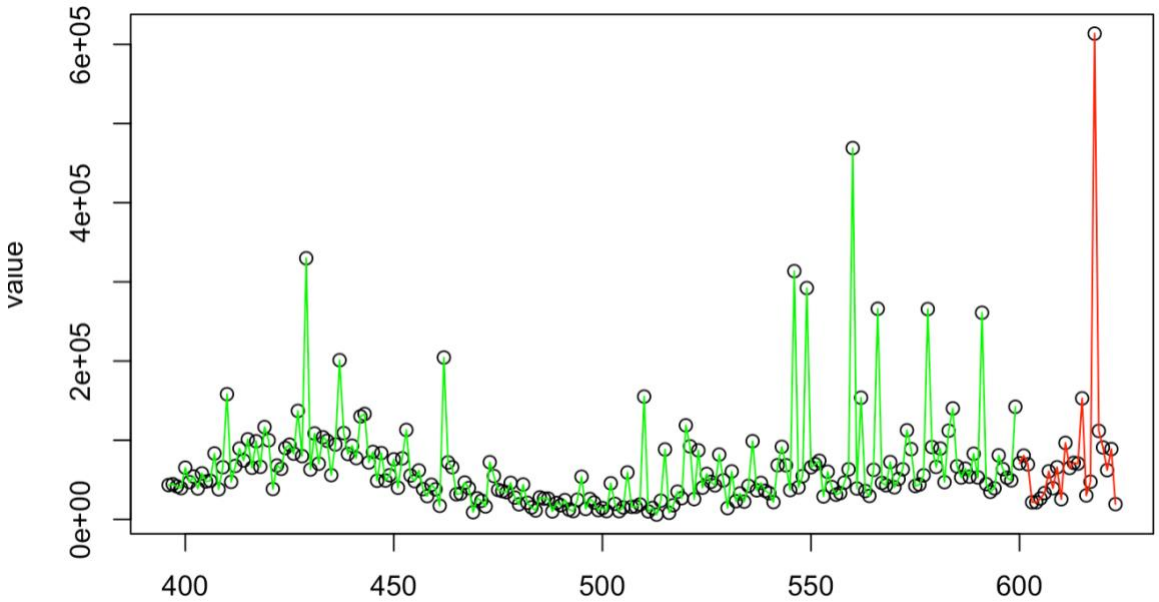
The expected future revenue for the neighborhood bath gate is predicted to be higher than the revenue generated in previous years. This is likely due to several factors, such as an increase in the number of people using the bath gate, an increase in visitors to the bath gate, and an increase in the number of times people visit the bath gate. The forecast indicates a positive trend in the expected revenue for the neighborhood bath gate, which is good news for the business. This suggests that the bath gate is likely to generate more revenue in the years to come.

Baychester



The Baychester neighborhood is anticipated to experience substantial revenue growth in the coming years. The projected revenue is expected to surpass the actual revenue, indicating a positive economic outlook for the area. This growth is attributed to various factors, including the Baychester neighborhood's expanding population, diverse community, and thriving businesses. Additionally, its strategic location within a major metropolitan area provides access to a vast customer and worker base. This forecasted revenue growth is a promising indicator for the Baychester neighborhood, suggesting economic expansion and potential advantages for residents, businesses, and the local government.

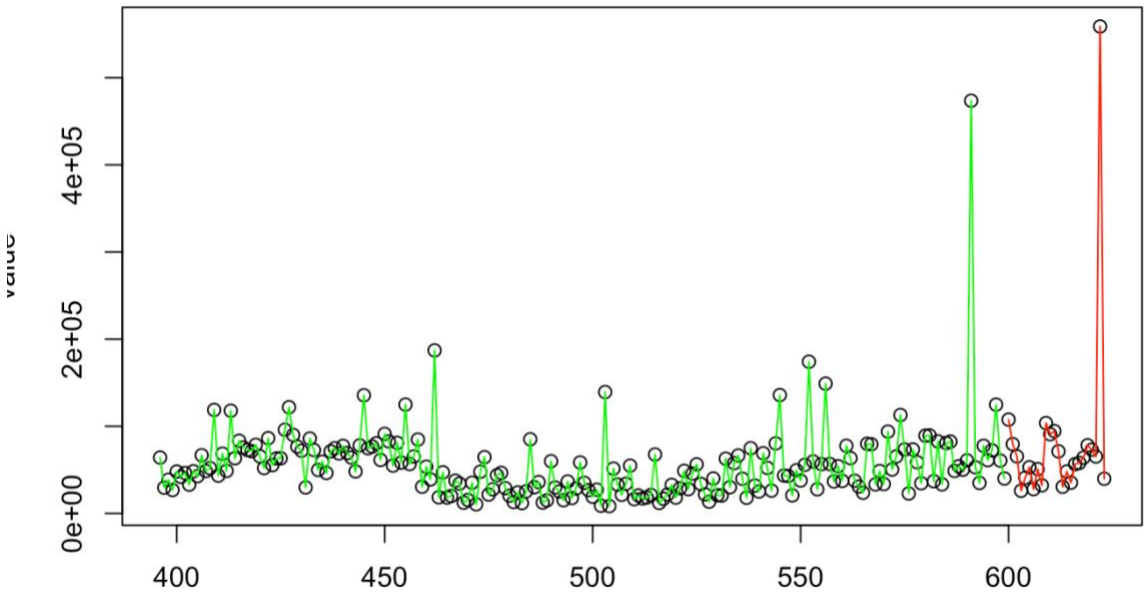
BRONXDALE



The Bronxdale neighborhood is predicted to experience significant revenue growth in the coming years. The projected revenue is expected to exceed the actual revenue, indicating a positive economic outlook for the area. This growth is attributed to various factors, including

the Bronxdale neighborhood's expanding population, diverse community, and thriving businesses. Additionally, its strategic location within a major metropolitan area provides access to a vast customer and worker base. This forecasted revenue growth is a promising indicator for the Bronxdale neighborhood, suggesting economic expansion and potential advantages for residents, businesses, and the local government. Furthermore, the forecasted revenue growth for the Bronxdale neighborhood is anticipated to surpass that of the Baychester neighborhood, suggesting that the Bronxdale neighborhood is expected to experience more rapid revenue growth in the coming years.

WAKEFIELD



The Wakefield neighborhood is anticipated to experience notable revenue growth in the coming years. The projected revenue is expected to surpass the actual revenue, indicating a positive economic outlook for the area. This growth is attributed to various factors, including the Wakefield neighborhood's expanding population, diverse community, and thriving businesses. Additionally, its strategic location within a major metropolitan area provides access to a vast customer and worker base. This forecasted revenue growth is a promising indicator for the Wakefield neighborhood, suggesting economic expansion and potential advantages for residents, businesses, and the local government.Furthermore, the forecasted revenue growth for the Wakefield neighborhood is similar to that of the Bronxdale neighborhood, suggesting that both neighborhoods are expected to experience comparable l evels of revenue growth in the coming years.

Based on our findings, Bronxdale is predicted to have more stable growth in potential revenue over years, and is expected to reach its maximum in the year 2025.