A CASE STUDY ON THE QUARTELY ALCOHOL CONSUMPTION FROM YEARS 2000 TO 2012

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Alcohol consumption is a widespread behavior and an important topic to study. This case study aims to provide an analysis of the quarterly alcohol consumption trends from the years 2000 to 2012. This investigation focuses on forecasting the Quarterly alcohol consumption and evaluating the prediction performance of different forecasting methods.

The Moving Average method, Exponential Smoothing Technique, Linear Regression model and Autoregressive Integrated Moving Average (ARIMA) will be used to perform and forecast the Quarterly Alcohol Consumption. With these models we will be able to predict and forecast the Quarterly Alcohol Consumption effectively and efficiently.

The findings from this case study will provide valuable insights into the patterns and changes in alcohol consumption over a 12-year span and could potentially be used by policymakers, researchers, and health organizations to inform future decision-making.

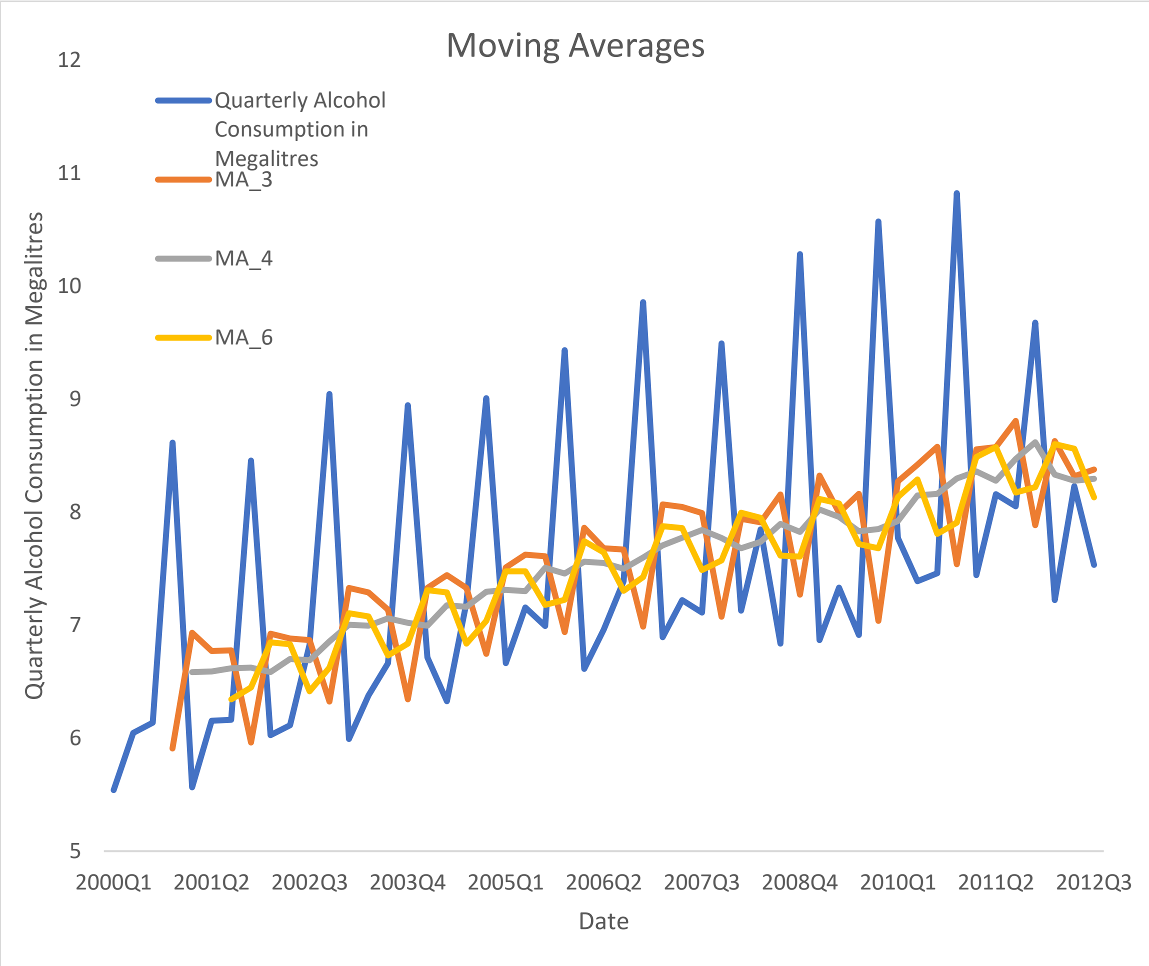
Keywords: Quarterly Alcohol Consumption, Moving Average arithmetic average, Exponential Smoothing Model, Linear Regression model, Autoregressive Integrated Moving Average (ARIMA).

INTRODUCTION

The data for this case study is readily accessible and does not require any additional processing. The data covers a 12-year span from Q1 2000 to Q4 2012, and the information available is on the quarterly distribution of alcohol consumption for this period. The standard for evaluating the performance of the various forecasting methods and models are the Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE).

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(Predicted_i - Actual_i)^2}{N}} \qquad \mathrm{MAE} = \frac{1}{n}\sum_{i=1}^{n}|x_i - x|$$

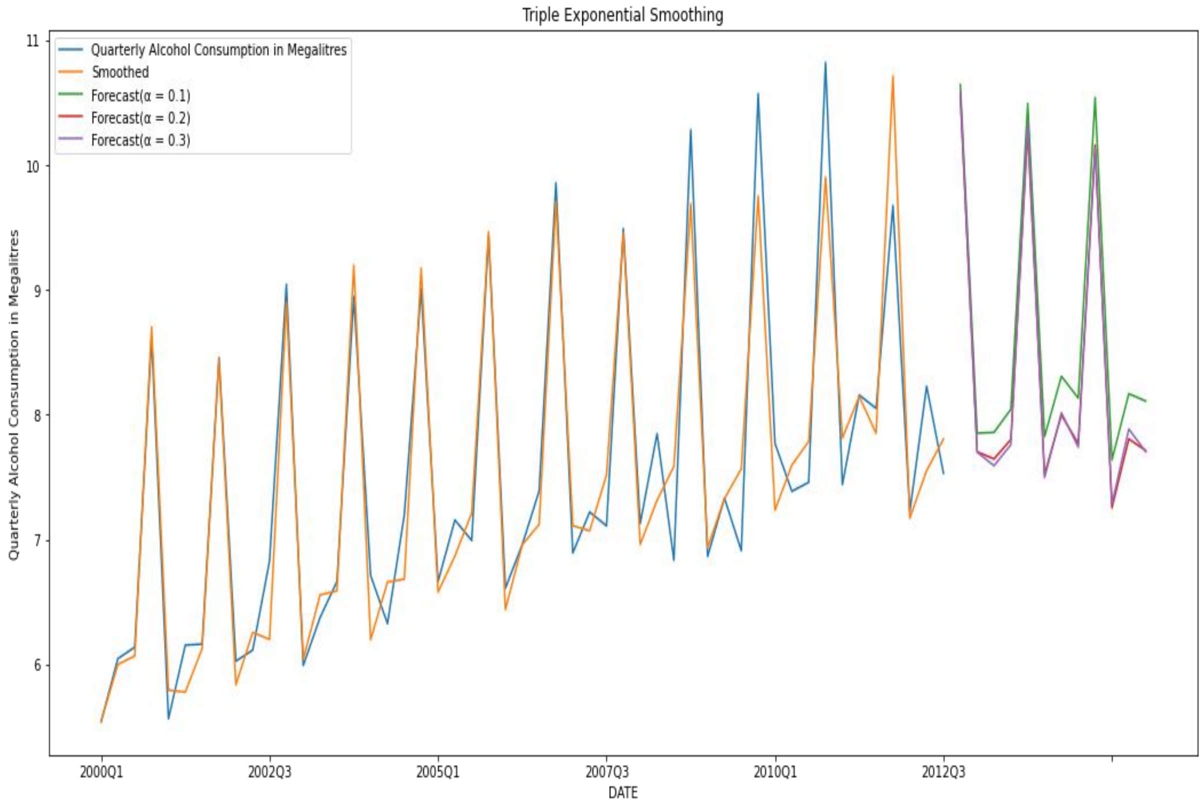
SIMEPLE MOVING AVERAGE METHOD RESULT



The Simple Moving Average forecasting technique was applied to predict Quarterly Alcohol Consumption (ML) using data from Q1 2000 to Q4 2012. Three different periods were used: Moving Average with Period 3, Moving Average with Period 4, and Moving Average with Period 6. The performance of each period was evaluated based on the RMSE and MAE scores. Results showed that the Moving Average with Period 4 performed the best, with an RMSE score of 0.92 and an MAE score of 1.16. Moving

Average with Period 6 had slightly worse results, with an RMSE score of 1.03 and an MAE score of 1.30. Moving Average with Period 3 had the worst performance, with an RMSE score of 1.27 and an MAE score of 1.56.

TRIPLE EXPONENTIAL SMOOTHING TECHNIQUE RESULT



Due to the presence of both a trend and a seasonal pattern in the data, Triple Exponential Smoothing was deemed suitable for the analysis. This is because the technique is specifically designed to capture and incorporate both trend and seasonality in time series data. Therefore, Triple Exponential Smoothing was used to model the data and obtain the required forecasts.

A plot was generated using three different values of alpha (α) which were 0.1, 0.2, and 0.3. The plot showed the Quarterly Alcohol distribution and the corresponding forecasted values. From the above plot, the following characteristics can be deduced:

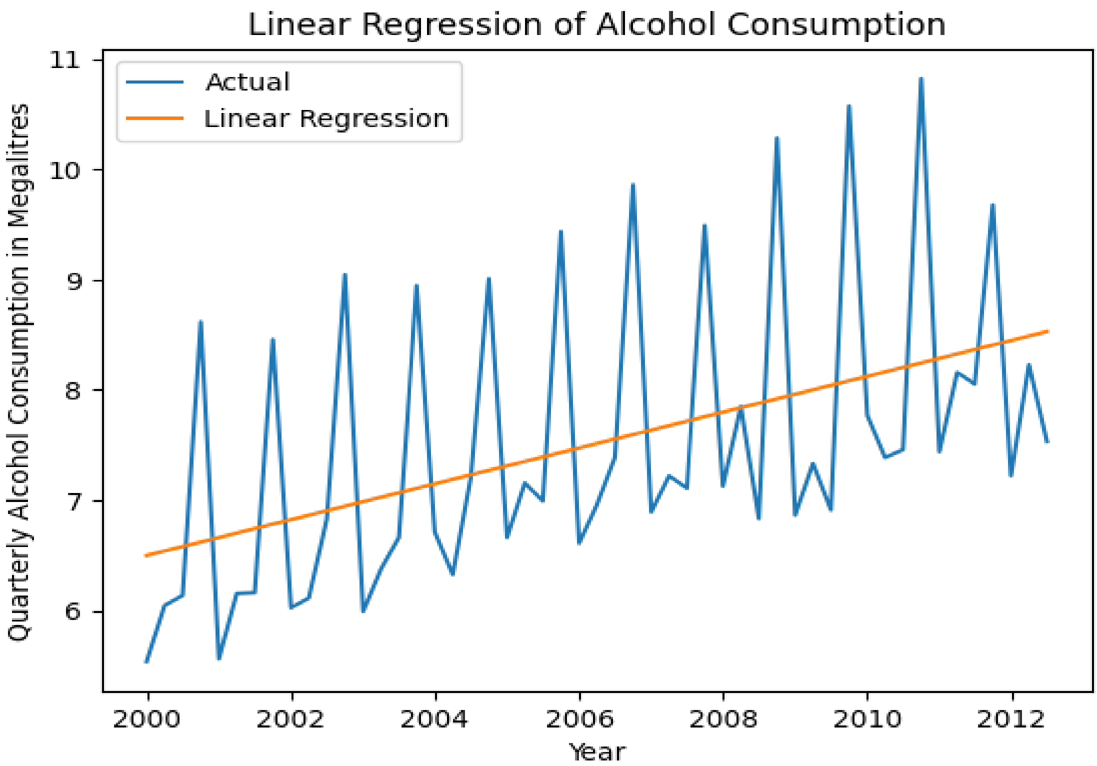
The Quarterly Alcohol Consumption appears to have a clear seasonal pattern with a peak in the fourth quarter of each year. The forecasted values generally follow the seasonal pattern of the Quarterly Alcohol Consumption.

When the value of alpha (α) is 0.1, the forecast shows a pattern that closely resembles the actual demand. This indicates that the model fits the data well and can capture the underlying patterns, resulting in a smoother and more stable forecast.

However, when the value of alpha is increased to 0.2 or 0.3, the pattern of the forecast becomes almost identical, and is quite different from the pattern observed for alpha equal to 0.1. This suggests that changing the value of alpha has a significant impact on the forecasted values, and the model is highly sensitive to this parameter. This can result in a more volatile forecast, which may be less reliable for making predictions.

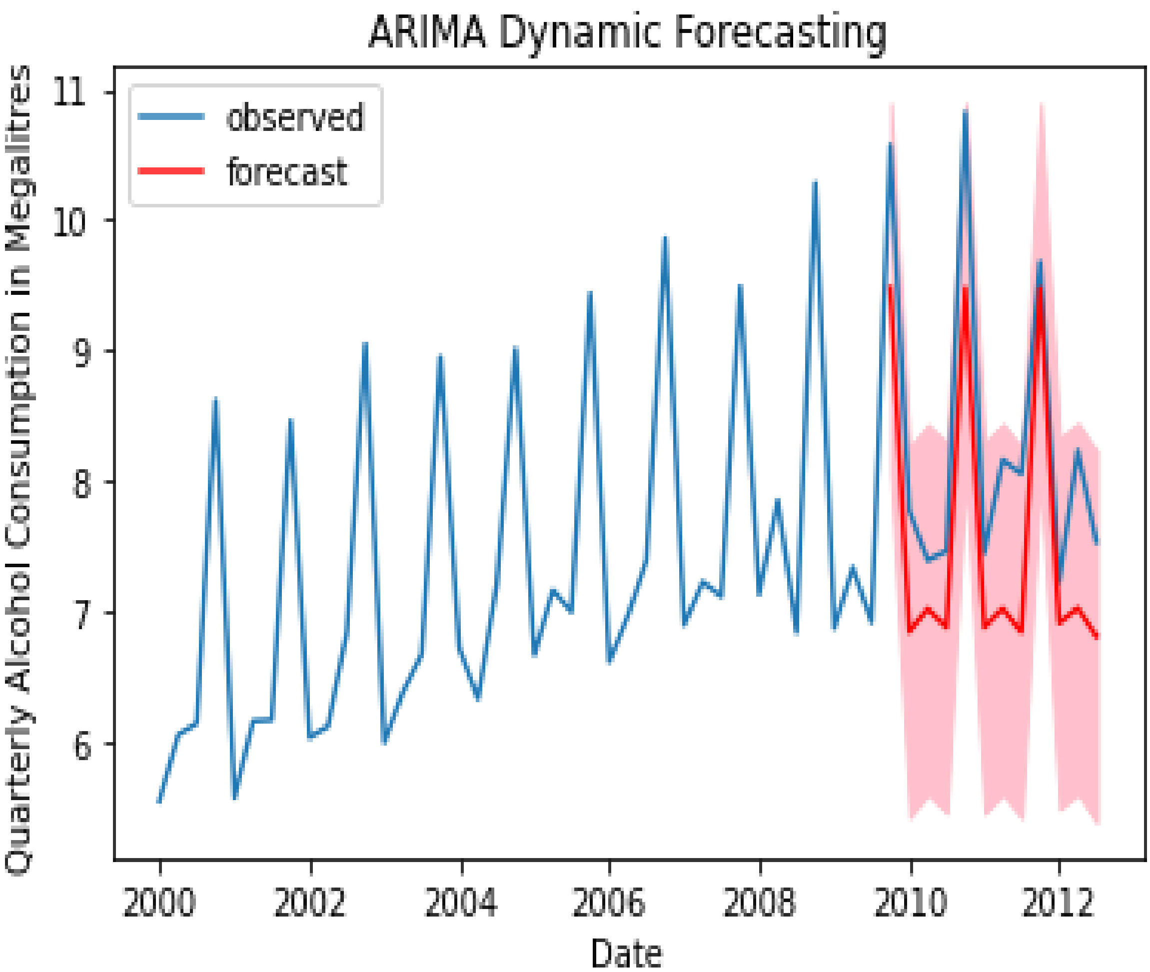
Overall, the plot provides insights into the relationship between the value of alpha and the forecasted values, as well as the seasonal pattern present in the Quarterly Alcohol distribution.

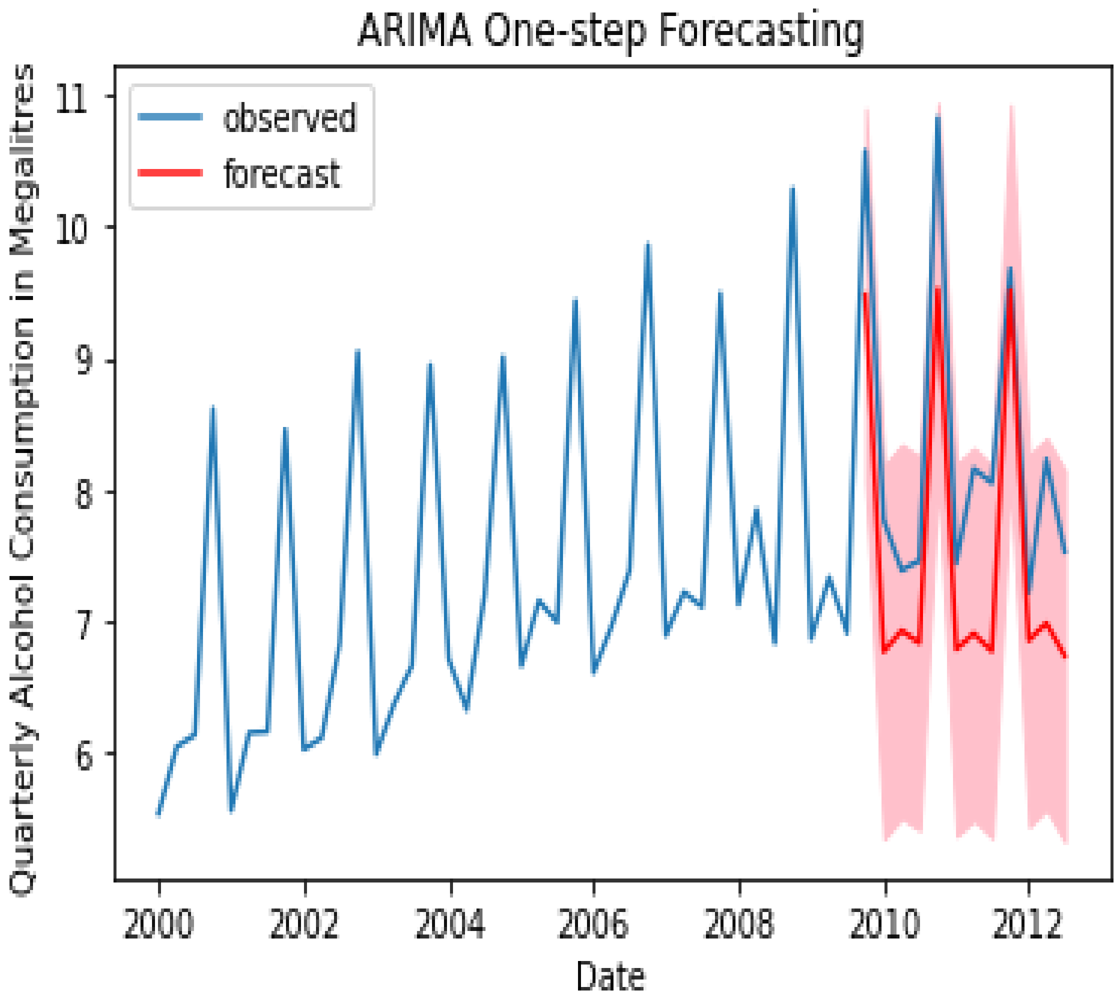
LINEAR REGRESSION MODEL RESULT



The forecasting model based on linear regression provided important information about the future patterns of Quarterly Alcohol Consumption. The model had an RMSE score of 0.94 and an MAE score of 1.16, suggesting that it had moderate accuracy in predicting demand, but with some degree of error in the forecasts. These scores indicate that the model can provide valuable insights into future demand.

ARIMA MODEL RESULT





The two ARIMA models, the ARIMA Dynamic Forecasting and ARIMA One-step forecasting, were used to forecast future demand patterns. The ARIMA Dynamic Forecasting had an RMSE score of 0.89 and a MAE score of 0.81, while the ARIMA One-step forecasting had an RMSE score of 0.93 and a MAE score of 0.85.

The lower RMSE and MAE scores of the ARIMA Dynamic Forecasting model suggest that it has a higher level of accuracy in predicting future demand patterns than the ARIMA One-step forecasting model. The ARIMA Dynamic Forecasting model has a more dynamic approach to forecasting future demand patterns, considering multiple time periods and trends in the data.

The ARIMA One-step forecasting model, on the other hand, has a simpler approach, only using one time period for forecasting. The higher RMSE and MAE scores for the ARIMA One-step forecasting model suggest that it may not capture the underlying patterns in the data as accurately as the ARIMA Dynamic Forecasting model.

PREDICTION ACCURACY FROM VARIOUS METHODS			
Method		**RMSE**	**MAE**
Moving Average Method	3 Period	1.27	1.56
	4 Period	0.92	1.16
	6 Period	1.03	1.3
Exponential Smoothing Technique	$\alpha = 0.1$	0.42	0.34
	$\alpha = 0.2$	0.3	0.24
	$\alpha = 0.3$	0.26	0.22
Linear Regression Model		1.16	0.94
ARIMA Dynamic Forecasting		0.89	0.81
ARIMA One-Step Forecasting		0.93	0.85

CONCLUSION

The table provided shows the RMSE and MAE scores for different forecasting methods used to forecast quarterly Alcohol consumption.

From the table, the Moving Average method with 4 periods had the lowest RMSE score of 0.92 and the lowest MAE score of 1.16, indicating that it performed the best among all Moving Average methods.

The Exponential Smoothing Technique with alpha value 0.3 had the lowest RMSE score of 0.26 and the lowest MAE score of 0.22, indicating that it performed the best among all Exponential Smoothing methods.

The Linear Regression Model had an RMSE score of 1.16 and an MAE score of 0.94, indicating that it had moderate accuracy in predicting future demand.

The ARIMA Dynamic Forecasting method had the lowest RMSE score of 0.89 and the lowest MAE score of 0.81. The ARIMA One-Step Forecasting method had an RMSE score of 0.93 and an MAE score of 0.85, indicating that it also had good accuracy in predicting future demand, although not as good as the ARIMA Dynamic Forecasting method.

In conclusion, based on the RMSE and MAE scores, the Exponential Smoothing Technique with alpha value 0.3 ($\alpha = 0.3$) performed the best in forecasting quarterly Alcohol consumption.

REFERENCES

A Case Study on Forecasting CSP in an Automobile Industry - Volume 3, No. 3, July 2014 - IJMERR

A Case Study on Forecasting CSP in an Automobile Industry - Volume 3, No. 3, July 2014 - IJMERR. (2023). Retrieved 19 February 2023, from http://www.ijmerr.com/show-124-179-1.html.