Energy Market and Battery Optimisation Project
MAST30034 Applied Data Science

Group 14

Bonus Task Approach

Assuming no future visibility of price, we forecast the future spot prices which will be used to determine the battery's charge and discharging behaviour in each period.

Stationarity is first checked since it is the primary assumption of most time series models. According to the Augmented Dicker-Fuller (ADF) Test, the spot prices are stationary in mean since the null hypothesis that a unit root is present is rejected with a p-value of 0. However, the series is not stationary in variance, so log transformation is applied to correct for changing volatility.

Time series split cross-validation is done for model selection. Table 1 summarises the time series models evaluated using the cross-validation period.

Time Series Model	Description	RMSE
Autoregressive, AR(1)	Linear regression model with the immediate preceding spot price as the explanatory variable.	0.08838
Moving Average, MA(1)	Linear regression model with the immediate preceding spot price forecast error as the explanatory variable.	0.07967
Autoregressive Moving Average, ARMA(1,1)	Combination of AR(1) and MA(1).	0.08849
Autoregressive Moving Average Exogenous, ARMAX(1,1)	Model which allows for demand and supply as exogenous explanatory variables, in addition to autoregressive and moving average dynamics.	0.08898
Vector Autoregressive, VAR(1)	Multivariate model which allows for feedback relationships between endogenous variables, namely spot price, demand and supply.	0.1211

Table 1: Performance of Time Series Models on the Cross-validation Period.

Since MA(1) has the lowest RMSE for the cross-validation dataset, it is selected as the final model. The model is then fitted on the training set. Using the estimated MA(1), the spot prices for periods in the test set are forecasted. These predicted spot prices are fed into the weighted future average algorithm, which is developed in the mandatory task to determine the optimal battery behaviour.

A slightly lower market revenue is generated as a result of using predicted spot prices as compared to actual spot prices. This reflects that challenges were imposed in price forecasting as the revenue largely depends on the accuracy of predictions.