Abstract No: PS-07

Time series models to forecast number of registered cars in Sri Lanka

D. S. Sanjeewani[1*], A. P. Hewaarachchi[1] and M. D. N. Gunaratne[2]

[1]Departmet of Statistics & Computer Science, Faculty of Science, University of Kelaniya, Sri Lanka
[2]Ministry of Industrial Export & Investment Promotion, Sri Lanka
sucharithasd@gmail.com*

Even though Sri Lanka is a developing country, the automobile industry of Sri Lanka displays rapid growth recently. The Department of Motor Traffic reports indicates that the number of vehicle registrations has been steadily increasing. Therefore, the analysis of car registrations is crucial for the economic development and legislation process of Sri Lanka. This study aims to predict the total number of registered cars and to predict the number of registered cars by categories i.e. brand new, reconditioned and locally manufactured. Time series analysis enables forecasting the number of registered cars based on the past car registration patterns and comparing them with current trends. This study uses the number of registered reconditioned, brand-new, and local cars from January 2008 to December 2018 and attempts to create better forecasts using Box-Jenkins time series models and Holt's double exponential smoothing technique. Furthermore, this study plan to test if one level, the bottom-up approach of hierarchical forecasting (number of total registered cars as the sum of registered reconditioned, brand-new and local cars) outperforms forecasting number of registered total cars as a whole. Firstly, 90% of the data was considered as the training set for the analysis, and the remaining 10% of the data was considered as the testing set. To accurately model the high volatility of data, generalized autoregressive conditional heteroscedasticity (GARCH) and exponential generalized autoregressive conditional heteroscedasticity (EGARCH) models were used. The Moving Average (MA)(1)+GARCH(1,1) model was fitted to predict reconditioned car registration data. The Autoregressive Integrated Moving Average (ARIMA)(4,1,7)+EARCH(1,1) model was fitted to brand-new car registration data. The ARIMA(1,1,7)+GARCH(1,1) model was fitted to analyze local car registrations over time. Finally, MA(1)+ autoregressive conditional heteroscedasticity (ARCH)(1) model was fitted to extrapolate total car registration data. The mean absolute percentage error (MAPE) was used as the accuracy measure since it does not depend on the scale. Hence, the model which gives the minimum MAPE was selected to forecast the number of registered cars. The fitted models indicate satisfactory forecast results, which are 13% in MAPE for reconditioned car registrations using Holt's double exponential technique, 18% in MAPE for brand new car registrations using ARIMA(4,1,7) + EGARCH(1,1) hybrid model, and 19% in MAPE for local car registrations using Holt's double exponential technique. The total number of car registration is predicted using the one level hierarchical forecasting technique with 13% in MAPE. Concerning the findings, the number of registered cars highly fluctuated over the period. Besides, ARIMA is not adequate to capture the volatility, and the hierarchical forecasting technique is better to forecast total car registration data other than forecast it as a whole. This study predicted the number of registered cars considering different car categories and comparing time series models with smoothing techniques. Moreover, novel methods such as EGARCH and hierarchical approach were used to make more accurate predictions. This study's major limitation is irregular variations due to the influence of external factors that could be addressed in future research.

Keywords: ARCH, GARCH, Time series forecasting model, Hierarchical forecasting, Holt's double exponential smoothing