

ETW3420

Principles of Forecasting and Applications

Topic 8 Pre-tutorial Activity

In this pre-tutorial activity, you will:

- (i) Estimate an OLS regression and an OLS regression with ARIMA errors.
- (ii) Forecast using an OLS regression with ARIMA errors.
- (iii) Learn the appropriate R functions to do the above.

Assignment Project Exam Help

Question 1

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Consider monthly sales and advertising data for an automotive parts company (data set `advert`).

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- (a) Plot the data using `autoplot`. Why is it useful to set `facets=TRUE`?

```
autoplot(advert, facets=TRUE)
```

Because the data are on different scales, they should not be plotted in the same panel. Setting `facets=TRUE` puts them in different panels.

- (b) Fit a standard regression model $y_t = a + bx_t + \eta_t$ where y_t denotes sales and x_t denotes advertising using the `tslm()` function.

```
(fit <- tslm(sales ~ advert, data=advert))
```

- (c) Show that the residuals have significant autocorrelation.

```
checkresiduals(fit)
```

- (d) What difference does it make if you use the `Arima` function instead:

```
Arima(advert[, 'sales'], xreg=advert[, 'advert'], order=c(0,0,0))
```

- Note that in the above code, the first argument specified is the dependent variable; the second argument specifies the X-regressor; while the third argument specifies the ARIMA order of the error term. Since we assume, for now, that η_t is white noise, it corresponds to an ARIMA(0,0,0) process.

(e) Refit the model using `auto.arima()`. How much difference does the error model make to the estimated parameters? What ARIMA model for the errors is selected?

```
(fit <- auto.arima(advert[, 'sales'], xreg=advert[, 'advert']))
```

- Note how the `auto.arima()` function automatically selects an ARIMA process for η_t . Also note that the first and second arguments specified in the command refer to the dependent and independent variables, respectively.
- From the output, there is first order differencing. The advert coefficient has changed a little. The error model is ARIMA(0,1,0).

(f) Check the residuals of the fitted model.

```
checkresiduals(fit)
```

(g) Assuming the advertising budget for the next six months is exactly 10 units per month, produce sales forecasts with prediction intervals for the next six months.

- To do this, you will need to specify the X-regressor representing these values as an `xreg` argument in the `forecast()` function. This is different from the `newdata` argument which you used in last week's tutorial.

```
(fc <- forecast(fit, xreg = rep(10,6)))
```

```
autoplot(fc) + xlab("Month") + ylab("Sales")
```