

ECON 4115/5115

Chapter 10. Dynamic Regression Models

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- The previous two methods (ETS and ARIMA) were pure time series forecasting models.
- Sometimes you want to include additional explanatory variables (i.e., X 's).
- The dynamic regression model is:

$$y_t = \beta_0 + \beta_1 x_{1,t} + \cdots + \beta_k x_{k,t} + \eta_t$$

where η_t follows an ARIMA(p, d, q) process.

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- The first step is to first difference non-stationary variables:

$$y'_t = \beta_0 + \beta_1 x'_{1,t} + \dots + \beta_k x'_{k,t} + \eta'_t$$

where η'_t follows an ARMA(p, q) process, $y'_t = y_t - y_{t-1}$, and $x'_t = x_t - x_{t-1}$.

- The model above can be estimated in *R* using: *ARIMA*($y \sim x + pdq(p, d, q)$).
- If you are unsure of (p, d, q), you can specify as: *ARIMA*($y \sim x$).
- Forecasts with a dynamic regression model require predicting future x_t 's and η_t .
- See R script #16 for a forecasting application using a dynamic regression model.