6 Time Series Regression 279

6.1 Modeling Trend by Using Polynomial Functions 280
\[ y_t = TR_t + \varepsilon_t \]
No trend: \( TR_t = \beta_0 \)
Linear Trend: \( TR_t = \beta_0 + \beta_1 t \)
\[ \text{Note equations on 285 are just the equations on 88 with different notation; nothing new.} \]
Quadratic Trend: \( TR_t = \beta_0 + \beta_1 t + \beta_2 t^2 \)
Higher degree polynomials "overfit" the sample but have poor predictive power
In-Sample versus Out-Of-Sample Validation (page 296)

6.2 Detecting Autocorrelation 288
If residuals are autocorrelated something is missing from model
Duirbin-Watson Statistic (assumes residuals are normally distributed)
\[ \text{Positive autocorrelation present if } d > d_{U,\alpha}, \text{ absent if } d < d_{L,\alpha} \]
\[ \text{Negative autocorrelation present if } 4-d > d_{U,\alpha}, \text{ absent if } 4-d < d_{L,\alpha} \]
Test for autocorrelation with unspecified sign.

6.3 Types of Seasonal Variation 295
Constant versus Increasing
Transformations again.
Multiplicative Decomposition (next chapter) is better

6.4 Modeling Seasonal Variation by Dummy Variables and Trigonometric Functions 298
Constant (additive) seasonal variation (not proportional to)
L-1 Dummy Variables
Trigonometric Functions, especially when L is large (e.g. daily)
Bottom of p. 303:
\[ \text{Dummy relies on accuracy of many parameter estimates,} \]
\[ \text{Trigonometric relies on accuracy of its assumptions} \]
Effect on Durbin-Watson Statistic

6.5 Growth Curve Models 304
\[ y_t - \beta_0, (\beta_1^t) \varepsilon_t \]
\[ \log(y_t) = \log(\beta_0) + t \cdot \log(\beta_1) + \log(\varepsilon_t) \]
Note \( \beta_1 > 0; \)
if \( 0 < \beta_1 < 1 \) then \( \log(\beta_0) < 0 \) (exponential decline)
if \( \beta_1 > 1 \) then \( \log(\beta_0) > 0 \) (exponential growth)
Effect on Durbin-Watson Statistic
We have to assume that \( \varepsilon_t \) follows the lognormal distribution so \( \log(\varepsilon_t) \) can follow the normal distribution

6.6 Handling First-Order Autocorrelation 309 Will be covered along with Section 7.3