Basic Regression Analysis with Time Series Data

1 The Nature of Time Series Data

TABLE 10.1

Partial Listing of Data on U.S. Inflation and Unemployment Rates, 1948–2003

Year	Inflation	Unemployment
1948	8.1	3.8
1949	−1.2	5.9
1950	1.3	5.3
1951	7.9	3.3
⋮	⋮	⋮
1998	1.6	4.5
1999	2.2	4.2
2000	3.4	4.0
2001	2.8	4.7
2002	1.6	5.8
2003	2.3	6.0

2 Examples of Time Series Regression Models

There are many time series regression models. Different models would be suitable for different types of relationship we want to estimate. Some examples of time series models are Static Model, AR (Autoregressive), ADL (Autoregressive Distributed Lag), FDL (Finite Distributed Lag), ARMA (Autoregressive Moving Average), ARCH (Autoregressive Conditional Heteroskedasticity) etc.

In this class we will talk about 2 examples 1) Static Models and 2) FDL.

2.1 Static Models

Studies a contemperaneous (occurring in the same period of time) relationship of variables.

For example:

2.2 Finite Distributed Lag Models

For example,

In general,

$$y_t = \alpha_0 + \delta_0 x_t + \delta_1 x_{t-1} + \delta_2 x_{t-2} + u_t$$

$\delta_0 = \frac{dy_t}{dx_t}$

$\delta_1 = \frac{dy_t}{dx_{t-1}}$

- Temporary change – assume that "x" changes from "c" to "$c+1$" in period t and remain at c in other periods.

- Permanent change – assume that "x" takes the value of "$c+1$" instead of "c" from period t on.

Compared with y_{t-1}, the value of y from period $t+2$ increases "permanently" by "$\delta_0+\delta_1+\delta_2$". This is called the "long-run" propensity or "long-run multiplier".

3 Properties of OLS under classical assumptions

Assumption TS1. Linear in Parameter – Y is linear in X.

Assumption TS2. No Perfect Collinearity

Assumption TS3. Zero Conditional Mean

***** Under Assumptions TS1 to TS3, $\hat{\beta}_{OLS}$ would be unbiased *****

Assumption TS4. Homoskedasticity

Assumption TS5. No Serial Correlation

***** Under Assumptions TS1 to TS5, $\hat{\beta}_{OLS}$ would be BLUE (best linear unbiased estimators)*****

3.1 The variance of $\hat{\beta}_{OLS}$ (under ass.TS1-TS5)