Econometric Techniques

For an exchange rate econometric model

$$s_t = X_t \cdot \Gamma + \varepsilon_t$$

Generally, both s_t (exchange rate) and X_t (e.g., M2) are non-stationary time series. If we regress this equation directly, we will get an inaccurate parameter estimation.

Solution: use following specifications

- First differences

$$s_t = X_t \cdot \Gamma + \varepsilon_t$$

$$\Rightarrow \Delta s_t = \Delta X_t \cdot \Gamma + u_t$$

  Now both Δs_t (exchange rate depreciation) and ΔX_t (e.g., M2 growth) are stationary time series, we can estimation the last equation directly.

- Error-Correction Specification (Example: Marginal propensity to consume)

  Suppose consumption C_t and disposable income Y_t are macroeconomic time series that are related in the long run (Permanent Income Hypothesis). Specifically, let average propensity to consume be 90%. That is, in the long run,

$$C_t = 0.9Y_t$$

  In the short run, however, if Y_t suddenly changes by ΔY_t, consumption C_t only changes by

$$\Delta C_t = 0.5\Delta Y_t$$

  That is, the short run marginal propensity to consume is 50%, and the long run marginal propensity to consume is 90%.

  The gap between current (i.e., short run) and equilibrium (i.e., long run) consumption decreases each period by 20%. i.e.,

$$\Delta C_t = 0.5\Delta Y_t - 0.2\left(C_{t-1} - 0.9Y_{t-1}\right) + \varepsilon_t$$

  where

  (1) $0.5\Delta Y_t$ is the short term impact of change in Y_t on C_t

  (2) $-0.2\left(C_{t-1} - 0.9\Delta Y_{t-1}\right)$ is the long-run gravitation towards the equilibrium relationship between the variables.

  Similarly, the error-correction specification form of the exchange rate model is

$$s_t - s_{t-k} = \delta_0 + \beta\left(X_t - X_{t-k}\right)\Gamma + \delta_1\left(s_{t-k} - X_{t-k}\Gamma\right) + u_t$$

  If we strip off the short run dynamics $\beta\left(X_t - X_{t-k}\right)\Gamma$, then we end up with

$$s_t - s_{t-k} = \delta_0 + \delta_1\left(s_{t-k} - X_{t-k}\Gamma\right) + u_t$$