

Assignment 5

1. In the study of interest rate structure, the continuous time model can be specified as:

$$r_{t+\Delta t} - r_t = (\alpha + \beta r_t) \Delta t + \varepsilon_{t+\Delta t} \quad (1)$$

where: $E[\varepsilon_{t+\Delta t}] = 0$ and $E[\varepsilon_{t+\Delta t}^2] = \sigma^2 r_t^{2\gamma} \Delta t$

Then, the model can be transformed to be discrete time model by setting $\Delta t = 1$. The discrete time model can be stated as:

$$r_{t+1} - r_t = \Delta r_t = \alpha + \beta r_t + \varepsilon_{t+1} \quad (2)$$

where: $E[\varepsilon_{t+1}] = 0$ and $E[\varepsilon_{t+1}^2] = \sigma^2 r_t^{2\gamma}$

The above model consists of four parameters including $\alpha, \beta, \sigma^2, \gamma$. The model can be estimate using GMM. Four moment condition equations can be stated as:

Zero mean condition: $E(\varepsilon_{t+1}) = 0$

Orthogonality condition: $E(\varepsilon_{t+1} r_t) = 0$

Variance condition: $E(\varepsilon_{t+1}^2 - \sigma^2 r_t^{2\gamma}) = 0$

Zero covariance condition: $E((\varepsilon_{t+1}^2 - \sigma^2 r_t^{2\gamma}) r_t) = 0$

The above model can be claimed as unrestricted model for other eight interest rate structure models which can be indicated as follows:

Model	α	β	σ^2	γ
(1) Unrestricted				
(2) Merton		0		0
(3) Vasicek				0
(4) CIR SR				0.5
(5) Dothan	0	0		1
(6) GBM	0			1
(7) Brennan & Schwartz				1
(8) CIR VR	0	0		1.5
(9) CEV	0			

From the given data set (assign5-1.dta):

- Estimate the interest rate structure models applying all 9 models using GMM. Also perform Overidentification Test. (Hint: command for generating $\Delta r_t = r_{t+1} - r_t$ is `gen dr=f.r-r`)
- Determine the most appropriated model using Wald Test.

2. From the model:

$$y_i = \alpha + \beta x_i + u_i \quad (3)$$

where: y_i is dependent variable

x_i is explanatory variable

u_i is stochastic error term

$E(u_i) = 0$ but $E(x_i u_i) \neq 0$.

From the given data set (`assign5-2.dta`):

- a. Estimate model (3) using OLS.
- b. Based on z_1, z_2, z_3, z_4 , determine the best set of instrumental variables, then, estimate model (3) using GMM.
- c. Determine whether OLS estimated results in (a) or GMM estimated results in (b) is more appropriate using the Hansen's J chi2 statistic test.