

Econ. 811
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Homework Set 1

Suppose that the instantaneous riskless interest rate follows the following stochastic process of Cox, Ingersol, Ross (1985)):

$$dr = \kappa(\bar{r} - r) dt + \sigma r^{0.5} dz$$

in which κ , \bar{r} , σ are constants. The ‘price of r -risk’ is assumed to be λr (i.e., the risk-adjusted drift in r is $\kappa(\bar{r} - r) - \lambda r$). Suppose the initial state is $r = 0.07$, and that the values of the fixed parameters $\kappa, \bar{r}, \lambda, \sigma$ are respectively 0.4, 0.1, -0.1 and 0.25.

1. Write a program calling CNSET and CNSTEP to determine the current price and yield to maturity (continuously compounded) of a \$100 face value Treasury Bill with 1 year to mature.
2. Determine the value of a 6 month European Call option on such a T-bill (fixed characteristics) with exercise price of \$95.
3. Determine the value of the above option if it were an American option.
4. Determine the current futures price of a 1 year T-bill deliverable 3 years from now. Express that price as a yield on 1 year bills.
5. Determine the current forward interest rate on 1 year bills deliverable 3 years from now.
6. Determine the objective expected value of interest rates on 1 year T-bills 3 years from now.

Bonus question: Determine the equilibrium par coupon rate on 3 year bonds with semiannual coupon payments. (Par coupon rate means the annual coupon rate that would make the current market value of the bond equal its maturity value.)