FIN 513: Homework #7

Due on Tuesday, April 10, 2018

Wanbae Park

Problem 1

(a) **Disagree.** Under CAPM, market price of risk for an arbitrary asset is defined as $\lambda_X = \rho_{X,M}\lambda_M$, where X is an arbitrary asset, and M denotes market. Let X denotes temperature, and if temperature increases are associated with lower stock prices, it means that correlation between temperature and stock price, $\rho_{X,M}$, is negative. Since market price of risk associated with stock price is positive, which associated with global warming will be negative, not positive.

(b) **Agree.** From the equation $\lambda_X = \rho_{X,M}\lambda_M$, market price of risk for an arbitrary asset is calculated as multiple of correlation coefficient between the asset and market and Sharpe ratio for the stock market. Since correlation coefficient is between -1 and 1, its absolute value must be smaller than the Sharpe ratio for the stock market.

Problem 2

(a) Since the market price of volatility risk is given as $\lambda(v) = \lambda_0 + \lambda_1 v$, risk-neutralized process of v is derived as follows.

$$\begin{aligned} dv_t &= \kappa(\bar{v} - v_t)dt - \lambda(v)s_v dt + s_v dW_t^v \\ &= (\kappa\bar{v} - \lambda_0 s_v - (\kappa + \lambda_1 s_v)v_t)dt + s_v dW_t^v \\ &= k^*(\bar{v}^* - v_t)dt + s_v dW_t^v \end{aligned}$$

where $\kappa^* = \kappa + \lambda_1 s_v$, and $\bar{v}^* = \frac{\kappa\bar{v} - \lambda_0 s_v}{\kappa^*}$. Since κ^* and $\bar{v}^*$ are constant, v_t follows Ornstein-Uhlenbeck process under risk-neutral measure.

(b)

(c)

Problem 3

Problem 4

Problem 5

(a)

(b)

(c)