

Exercise Sheet 3:

1. Shin (2011) Chapter 3, section 3.3 demonstrates that a risk averse hedge fund (with mean-variance objective function) will hold a mean-variance efficient portfolio.
 - (a) In section 3.4, he argues that if the hedge fund had a risk neutral objective and a VaR constraint, then the first order conditions will look just like the mean-variance objective. Prove that assertion. Also justify his claim that risk appetite and apparent risk aversion may change rapidly in a volatile market.
 - (b) He also claims in section 3.5 that his model can justify endogenous risk. He explains the difficulties that Long Term Capital and other trading operations face in volatile markets. Justify his claims.

2. Shin (2011) Ch.5 on Assets and Liabilities.
 - (a) In Section 5.2 Shin sets out a simple model of a pension fund. Explain the impact on the balance sheet of differences in duration on liabilities and assets. Explain the reason why the demand for a perpetuity will rise exponentially as the interest rate falls. If the demand for perpetuities was not perfectly competitive and the insurance company was a large demander in that market, what would that imply about the price for perpetuities?
 - (b) In Section 5.3, Shin discusses a university endowment problem when there are no long dated bonds or perpetuities. Explain the dangers of low interest rates and debt rollover for the university endowment.
 - (c) Using your analysis in (a) and (b) explain one of the dangers inherent in a zero interest rate policy used by a central bank.

3. Consider a pension fund that has a fixed liability L at $t = 2$, and fixed payments P over the period $t = 0, 1$. At time $t = 0$ using the observed term structure of interest rates the fund has the present value of assets equal to the present value of the liability.
 - (a) If the short term interest rate follows a Ho-Lee binomial process can you hedge the random interest rate so that the present value of assets equals the present value of liabilities at each node on the tree? Explain.
 - (b) Assume that there is an incomplete set of traded bonds, so that there is only a short term rate of interest at each node of the binomial tree and no long bond at date $t = 0$ paying off at $t = 2$. Can you hedge the assets and liabilities exactly? Why? What does that imply about interest rate risks?

4. In Crean's (2012) notes on assessing credit risk, he mentions specific industries that create major credit problems. In Crean Milne (2015) Section 3 they are modeled as Strategic Industry Risks (SIRS).
 - (a) Sketch the basic model with certainty. (Section 3. A.1.)
 - (b) Extend the model to risk (Section 3.A.2).
 - (c) Show that if in the low state the demand is sufficiently depressed that prices will be below marginal cost. Is this efficient? Is this an inefficient fire-sale? Why?
 - (d) Can the model allow for a short down-turn in demand or a longer recession? Show how future expectations will impact on initial investment in capacity, production and storage of the industry commodity.

5. In Crean Milne (Section 3.C.5.3):
 - (a) Show that with regulatory constraints on production, that prices will be higher than the unregulated equilibrium. Who gains and loses? Who will lobby for the constraints? Why?
 - (b) Given that governments impose zoning restrictions on land for housing, then consider the economic and financial implications of a government considering relaxing those restrictions, on land and real estate prices, the owners of houses and the collateral of banks issuing mortgages. Who gains and who loses?
 - (c) If the banks insure against mortgage defaults with an insurer, then how would you price mortgage insurance? An actuary asks what historical data you will use in your pricing. What will you tell her? (Hint: You have heard rumors that the government is considering relaxing zoning restrictions.)