

Math GR 5320: Financial Risk Management and Regulation

Assignment 1

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Due next Thursday by 1:00 pm.

For help, please post questions on the Q&A tab in Piazza:

https://piazza.com/columbia/fall2016/mathg5320_001_2016_3/home

1. Risk management definition

What is financial risk management?

2. Risk management process

What are the steps involved in the risk management process?

3. Risk identification

Classify each of the following risks and explain why that classification holds. Risk classifications are market risk, credit risk, idiosyncratic risk, counterparty risk, model risk, liquidity risk operational risk, compliance and regulatory risk, reputational risk, and moral hazard.

- (a) Risk that bond positions lose value due to rising interest rates.
- (b) Potential losses due to not being able to rebalance a hedge quickly enough.
- (c) Risk that equity prices might rise, causing a loss on puts that were purchased.
- (d) Risk to the bank that a corporate client might default, causing a loss on the swaps that the client entered into with the bank.
- (e) Risk to the bank that people who took out mortgages will be unable to make their monthly payments.
- (f) Risk that traders will take on large long term risks to effect short term gains that increase their bonuses.
- (g) Risk that parameter estimates are very noisy or inaccurate.
- (h) Risk that firm will go bankrupt due to inability to borrow additional funds.

4. Position risks

Give examples of at least 2 risks that each of the following positions are exposed to. For each risk, give an example of an event that would realize that risk.

- (a) Long stock position
- (b) Short stock position
- (c) Long bond position
- (d) Interest rate swap position
- (e) Cross currency swap

5. Risk measures

We defined the VaR of a portfolio with time t value of V_t as $V_0 - F^{-1}(1 - p)$ and the PFE of the portfolio as $F^{-1}(p)$, where $F(X)$ is the CDF of the future portfolio values:

$$F(X) = P[V_t \leq X] = E^P[1_{V_t \leq X}].$$

Sometimes the VaR is expressed as $G^{-1}(p)$, where $G(X)$ is the probability that the losses are less than X :

$$G(X) = P[V_0 - V_t < X]$$

- (a) What is the relationship between F and G ?
- (b) Sometimes G is instead defined as the probability that the losses do not exceed X :

$$G(X) = P[V_0 - V_t \leq X]$$

How would this change the VaR?