

CS774: Advanced Computational Finance; Fall 2009

- What has happened in the Financial Markets?
- Many banks and insurance companies have become insolvent
- Governments have bailed out many large financial institutions
- Trillions of dollars of wealth has evaporated
- Is this a failure of financial engineering?

Academic Warning Bells

From a paper we wrote in 2002, referring to financial contracts sold by insurance companies

"If one adopts the no-arbitrage perspective...the current deferred fees being charged are insufficient to establish a dynamic hedge for providing the guarantee... **This finding might raise concerns at institutions writing such contracts.**"

Response from insurance executives, 2002

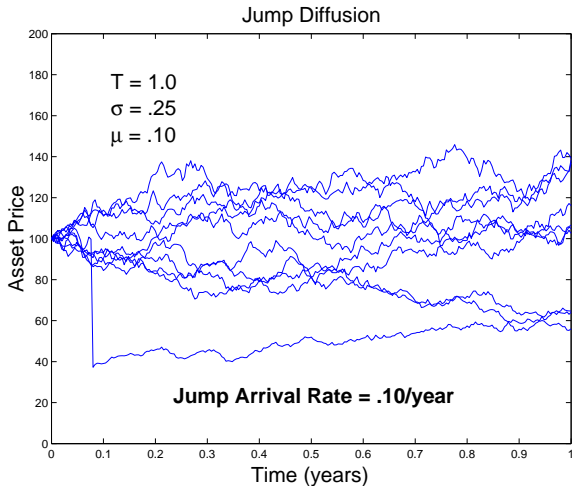
"What do you know? If you were smart, you'd be making millions like us."

Report on Business, December 2, 2008

"...massive future losses...sent Manulife shares reeling...strategy of not fully hedging products..."

Model of Stock Price Process: Jump Diffusion

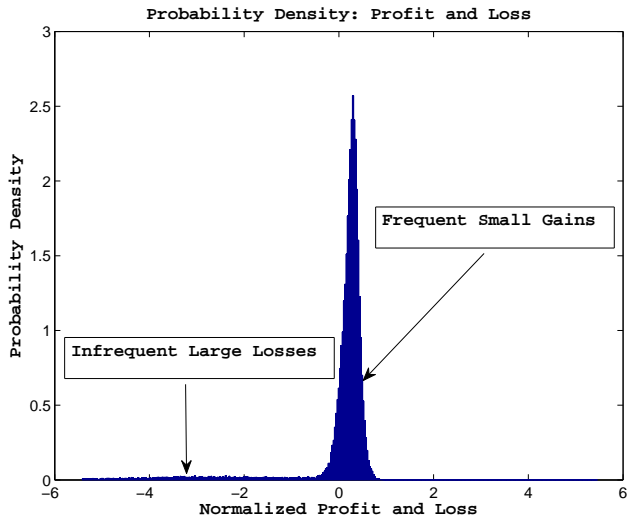
- Most of the time, stocks follow a continuous random walk, punctuated by occasional large drops/jumps



Stupid Idea

- Suppose real world stocks follow a Jump Diffusion process
- You work at a bank, and sell financial contracts (derivative securities), and hedge your exposure
- But, you assume the real world follows a continuous random walk.
 - You ignore the possibility of sudden market crashes.
 - i.e. you are using the wrong model.
- What happens? We'll simulate this trading strategy

Simulation of Stupid Strategy



Normalized P&L

$$= \frac{\text{P\&L}}{\text{Contract Price}}$$

- Note peak of density
 \Rightarrow positive profit

Stupid Idea=Very Smart!

- Most of the time, you make lots of money (use leverage to magnify frequent small gains)
- The CEO is happy, your shareholders are happy, you get paid a large bonus
- This goes on for some time, then a crash occurs (the tail risk)
- You get to retire rich (you keep your bonus), your shareholders lose their shirts, and the government bails out the bank
- Sound familiar?

Want to Know More About This?

- In CS774, we will consider numerical methods for valuing/hedging financial derivatives (options)
 - Monte Carlo (simulation), Tree (lattice), Numerical PDE
 - Particular attention paid to methods for modelling real market effects: jumps, liquidity, algorithmic trading, price impact

Background Required

- CS370 or 371 and STAT 231 or STAT 241 (intro numerical computation, statistics)
- You need to remember basic calculus and linear algebra
- *No finance* knowledge will be assumed!
 - We will cover any finance necessary
- You learn finance by modelling/simulation

CS 774: Fall 2009

Course Evaluation

- Two Assignments (not marked)
- A project

Class Times: MWF 3:30-4:20 MC 2036: First Class Monday
September 14

More information

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