Model Risk and its Implications

IIR CDO Summit

June 2006

(The author's views do not represent those of his employer.)

Outline

- What is a model ?
- How are models useful ?
- Model risk
- Model validation
- Model capabilities and limitations

Last minute addition !

Models are absolutely necessary
(or unavoidable ... depending on one's view)

Cannot perform risk measurement,
risk management, accounting, or even
trade documentation (?) without models

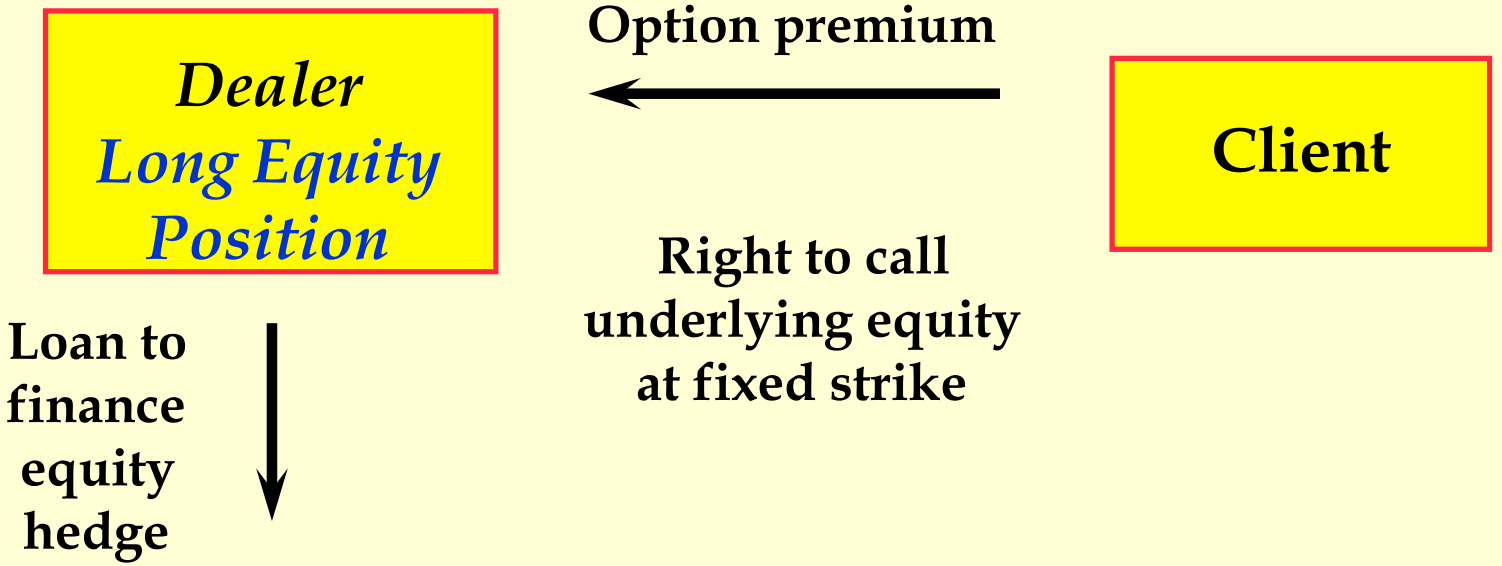
What is a model ?

- **Not as obvious as it may seem !**
- **Different for different people**
- **Can be philosophical**

How are models useful ?

- **Most obvious: give the "right answer"**
- **Much more beyond that: give guidance on how to think about the problem; approximations and limitations evident**
- **Example: Black-Scholes option model**
- **Mixed example: Monte Carlo simulations**
- **Mixed example: BIS capital adequacy**
- **Live example: Systemic risk**

How are models useful ?



Black-Scholes Option Analysis

Black-Scholes Option Analysis

* Greatest attribute is not that the "answer is right" but that we see how the answer arises
* Recipe for hedging
* No dependence on expected return ... "risk-neutral" valuation
* Pre-eminence of volatility
* Teaches traders "how to think"
* Assumptions and limitations obvious

Monte Carlo Simulations

* **Generate probabilistic outcome of future event by "random" simulation**
* **Often gives only an answer .... very little insight**
* **Must exercise more caution**
* **Not as sophisticated as widely believed**
* **Still .... getting an answer is useful !**

What are model risks ?

- **Most evidently .... models can give the wrong answer**
  - **2 dealers can disagree on price**
  - **more likely the model hedging parameters will be wrong and the dealer will be mis-hedged (with loss potential)**

What are model risks ?

- **Beyond being "wrong", a model can be "<u>spectacularly</u> wrong" !**
  - **trading strategy or pattern is built around the model flaw**
  - **one example is the NatWest option story, the best is the Kidder-Peabody drama**

Kidder-Peabody

- **Flawed internal model encouraged the trading desk to take a huge Treasury PO position**
- **The "profit" was > $ 300 MM .... yet little enthusiasm to understand**
- **Was the trader dishonest or clueless ? Does it matter ?**

What are model risks ?

- **A bad model may lead to bad decisions**

  .... the risk is the detriment to the firm

  - good example is a bank that makes a L+150 loan to a risky borrower

  - the return on regulatory capital is about 19% .... which is "good" regardless of the true borrower quality

What are model risks ?

- **An incomplete model breeds complacency**
  - **imagine a bank that models its "credit" risks and "market" risks but neglects its funding risk**
  - **banks "lend long and borrow short"**
  - **if a risk is not in a model, it may not be "on the radar screen"**

Remedies to model risks

- **Clearly define the purpose of the model and use it within this defined purpose**
- **Document the model and "encourage" the users to explain/defend it to others**
- **Users should be experts**
- **Continuous validation and improvement**

Standard Thoughts

- **Full documentation**
- **Validation by an “independent” group**
- **Evaluate “special cases”**
- **External presentations and discussions**
- **“Debugging” can go on for years ....**

Evaluate Model Performance !

- **Obvious idea .... but rarely practiced**

  Example: Option pricing model shows how to hedge. After option expires, analyze all hedge trades to determine profit.

- **Make measurements to compare to model projections .... critical !**

Measurements for Model Evaluation

- **Be prepared for protests that "there are no measurements"**
- **Surprising that profit & loss is so rarely subjected to analysis**

Capabilities

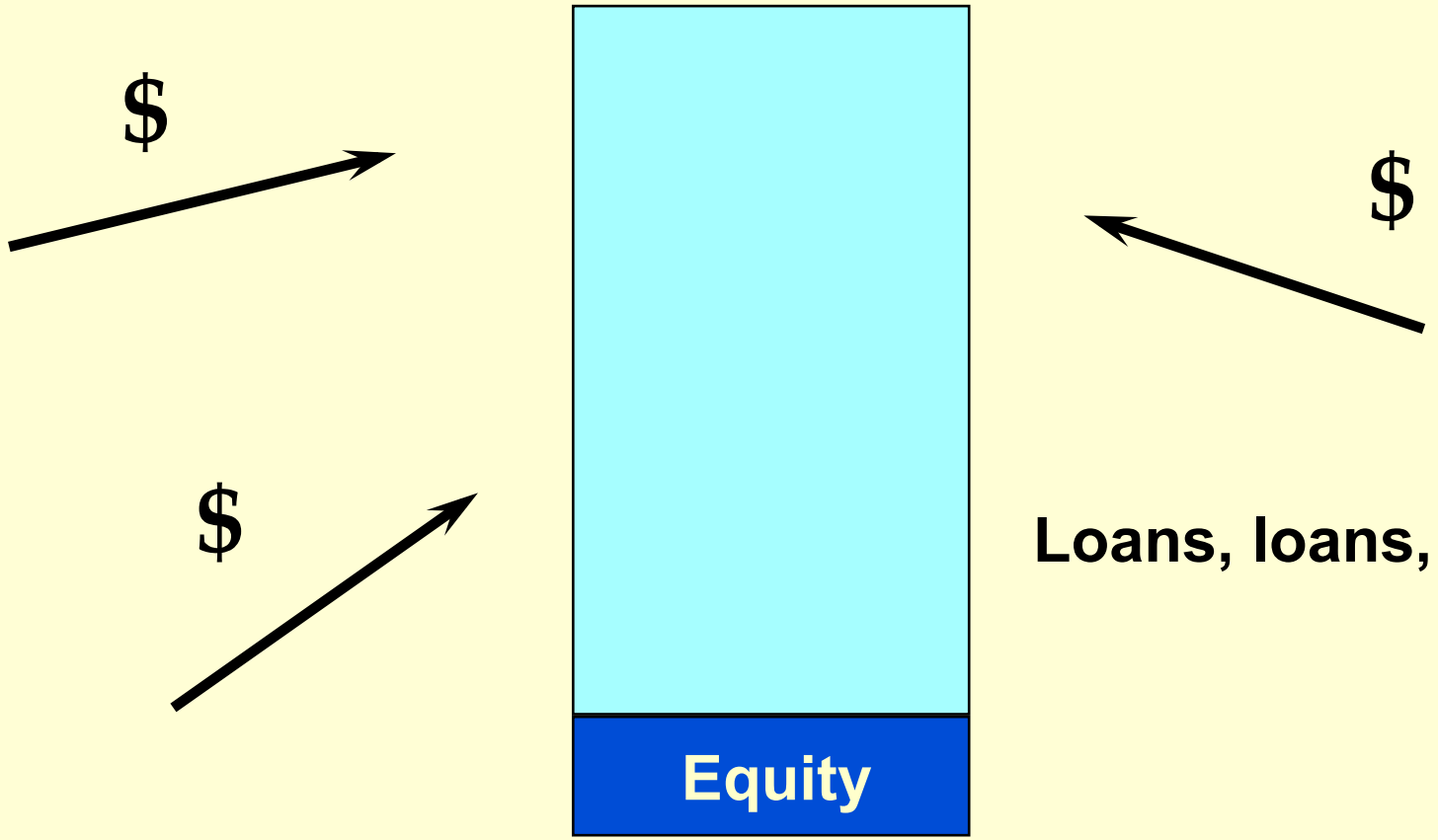
- **Good models do more than give the right answers, they help one think, they create a language (Black-Scholes)**

Limitations

- **Models are (almost) never completely correct**
- **Always need judgment, never "fire-and-forget"**
- **Models can only reflect "embedded intelligence"**

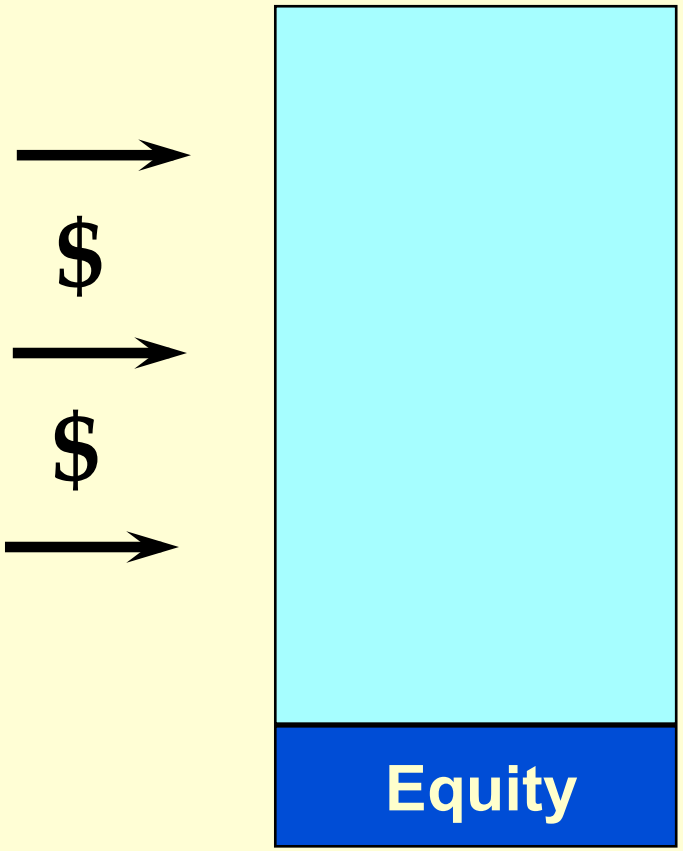
Final Example

Highly leveraged portfolio concentrated in one type of investment



Model Capabilities and Limitations

Highly leveraged portfolio concentrated in one type of investment



"Forgotten" Risks

- **Liabilities shorter than assets if lenders can call collateral**
- **Portfolio value will fall drastically if the fund must liquidate in a "disorderly" manner**

Are these risks in the model ?

Summary

- What is a model ?
- How are models useful ?
- Model risk
- Model validation
- Model capabilities and limitations