

# Structured Credit'08: The Game of Gamma

*New Developments in Structured Products  
& Credit Derivatives*

Paris, March 2008

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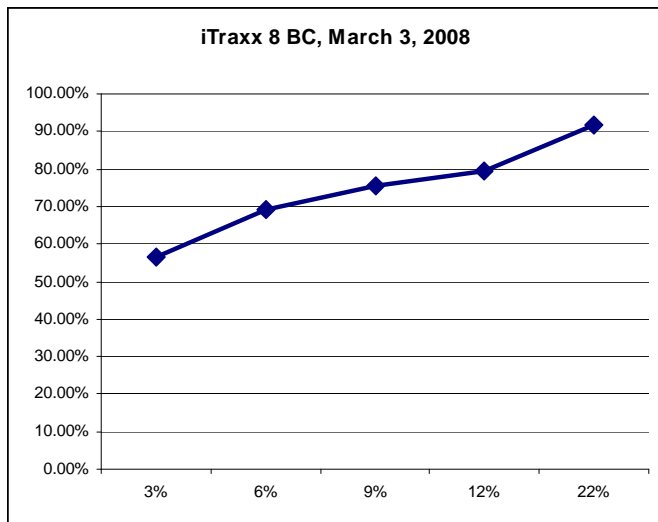
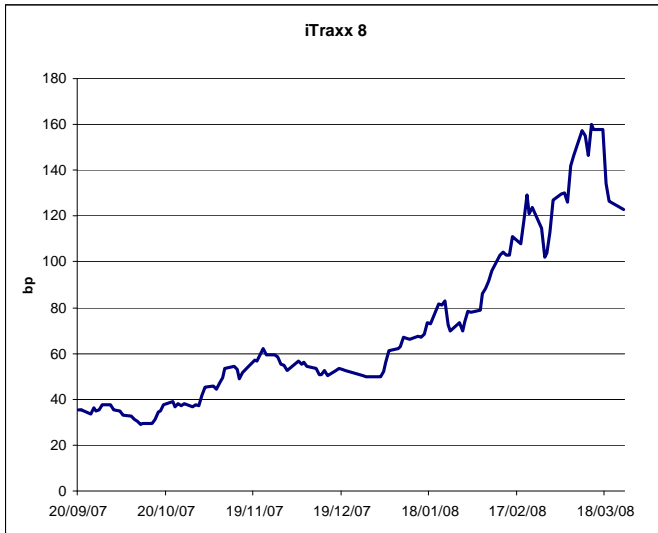
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# Outline

- Credit crunch, low liquidity and high vols:
  - fewer traditional deals
  - active hedging existing books
  - urgent need for adequate practical models
  - move to the hybrid universe; new models needed too
- Old models: the gamma issue on top of the term structure
  - are (even working) copulas fundamentally bad?
- New models: better handling of dependency and illiquidity
  - smooth fat-tail copulas
  - dynamic models...
- ... to be coupled with other risks for hybrid modeling

# Credit crunch, low liquidity and high vols



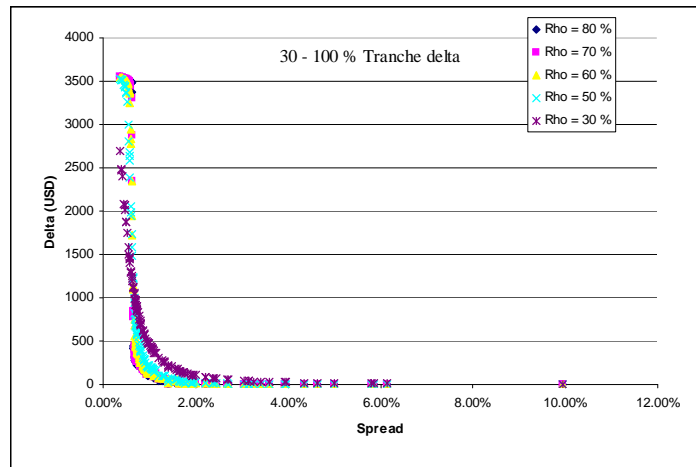
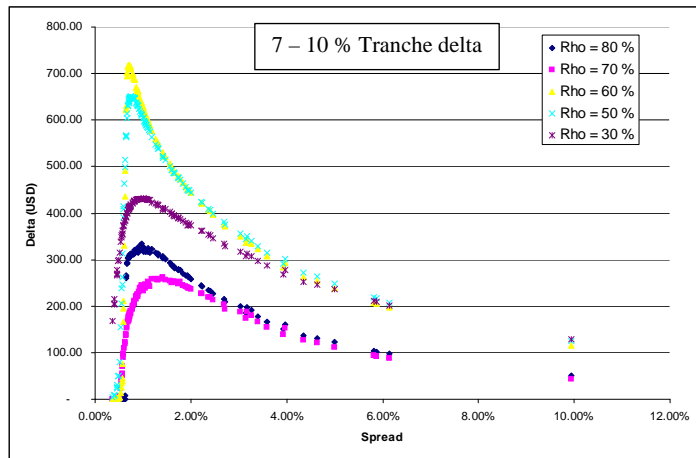
## Do practical models still work?

1. Index quadrupled
2. Shift of risk to senior tranches
- **Base correlation high and flat**
3. Liquidity significantly deteriorated
4. Daily volatility (based on quotes) almost doubled:

Daily Historical Vol	
First 2 months	4.57%
Last month	7.27%
Average	5.27%

- **Hard to manage gamma**

# Are (even working) copulas fundamentally bad? (I)



*Note: joint work with Gabriele Butti*

- **New Issue:** general factor copulas that calibrate to a given maturity can generate high single name gamma.
  - **Fundamental explanation:** high dependency copulas (up to the upper Hoeffding-Frechet bound) imply ordering of default times
  - In the limit, one to one correspondence between the names and tranches:
    - Delta localization
    - High gamma for the “boundary” names
- We need an approach that will avoid ordering of the default times as the result of their coupling**

# Are (even working) copulas fundamentally bad? (II)

A more practical setting: factor copula, introducing a “multimodal” loss distribution

A (sufficiently) general factor copula implied conditional probability:

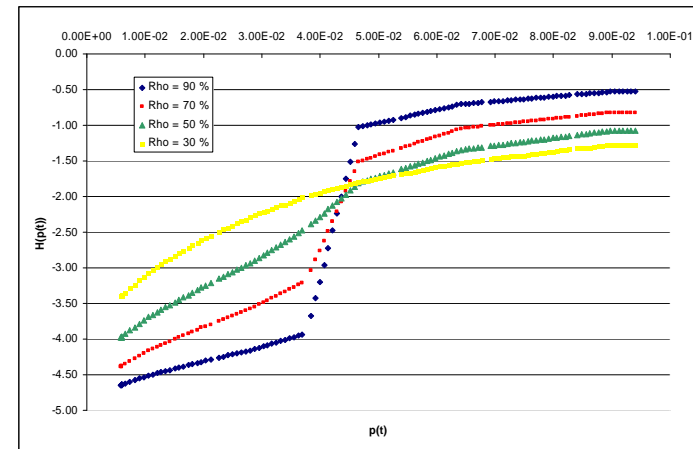
$$\tilde{p}(t_i)|G = \Phi \left( \frac{H(t_i) - \beta G}{\sqrt{1 - \beta^2}} \right)$$

Originally introduced to “consistently” handle term structure of the copula parameters in discrete time.

In general  $H(t)$  must be calibrated numerically (it is a “default barrier”/“firm value barrier”, etc.

$\beta$  - “correlation”

$G$  - factor with a multimodal distribution



➤ If copula introduces “multiple defaults” through multimodality, this will be compensated by kinks in  $H(t)$

➤ Fundamentally same effect as before: delta localization

If we need fat tails or multimodality there should be no kinks in the barrier

# New Models: Smoothness and Dynamism

## Copula shortcomings:

- ✓ No term structure, strictly speaking
- ✓ Fat tails vs multimodality trade-off
- ✓ Delta localization, causing high gamma
- ✓ Other well known issues (difficulty to conditioning on loss, etc)

Way forward: use of microscopic (bottom-up) dynamic models, e.g. with coupling via common compensated jumps

- No default time ordering
- Natural coupling with other dynamic risks for hybrid pricing

## Challenges:

- ☆ Sufficiently flexible parameterization to fit the term structure
- ☆ Generalization to the bespokes, with standard requirements
- ☆ Factorization of the relevant correlation having marginal vol fixed (still to come)

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