

Calculating Potential Exposure at CCG

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November 5, 2007

Overview

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Existing MPE technology

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- The current technology was developed in various stages since mid-2002 by RMG. Over time, we expanded it based on various requests from the Credit group and the Front Office.
- There were several attempts to standardize the runs and provide a GUI because the requirements kept ramping up.
- Calculating the MPE should be straightforward, easy, and (preferably) not require RMG involvement. We are not there yet.

“Features” of existing MPE technology

- Developed in Matlab. Licenses can sometimes be an issue.
- Matlab templates used were often an older version (London).
- Currently only runs interactively.
- Matlab runs on local PC so big portfolios cannot fit in memory.
- Have support for many deal types.
- One run cannot be combined with an existing portfolio.
- Backtesting is done by request, not fully automated.
- Running calculators in SecDB and importing positions in Matlab is slow.
- Long deals can take a long time to simulate.
- The price simulation uses SecDB volatilities, price caps, do the prices make sense?
- Who did not have problems with a heat rate deal? Is Haibin in today?

Current/Old price simulation model

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- One factor GBM with mean reversion to mimic SecDB (as in 2002).
- The volatilities used are the SecDB implied vols. Market quotes are sparse. Some power vol quotes were very high. Other commodities were not marked, and had very low implied vols.
- Based on our initial experience with power, we added a 50% vol cut to the SecDB vols. It was not a good idea for other commods.
- Mean reversion was set by commodity but the levels were too low. This was always an issue, because prices would difuse to historically ridiculous levels after 3 years.
- We introduced price caps/floors to remedy this.
- We boldly simulate a 20 year deal when we have no fundamental reason to believe forward marks beyond 4th year out (at best).

Current/Old price simulation model

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- Correlations were estimated historically.
- Introduced heat-rate caps/floors too.
- Problem with ancillary curves, or curves that move infrequently, see NOX, etc.

If we have so many issues are all our MPE numbers wrong? NO!

But if you know of so many issues why don't you fix it? We are!

Goals for the new MPE

- Ability to calculate exposure by counterparty, by portfolio, by deal.
- Have realistic price simulations based on history.
- Have daily reporting on future exposures and changes.
- Have ability to report on historical MPE by counterparty.
- Periodic (automatic) backtesting of predetermined deals.
- Improved interaction with SecDB for position gathering.
- No more bargaining with the Origination on the “vol cut”. If Origination requests a different exposure, the reason will be entered in a database.

Challenges for the New/Current MPE

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- Simulation of a few correlated time series is trivial.
- For our problem, major challenge is the scale of the data.
 - Around 700 distinct curves with various history
 - 24 to 60 contract month for each curve
 - Correlations among 30,000 curve/month must be kept
- Positions with about 800 counterparties.

Price simulation

Understanding of the historical data is crucial in forward simulation.

- 1 Took a hierarchical view on the data and built a curve pedigree.
There are parents and children curves.
- 2 Use PCA for dimension reduction.
- 3 Simulate correlated parents based on OU process assumption.
- 4 Simulated children based on simulated parents.

Practically:

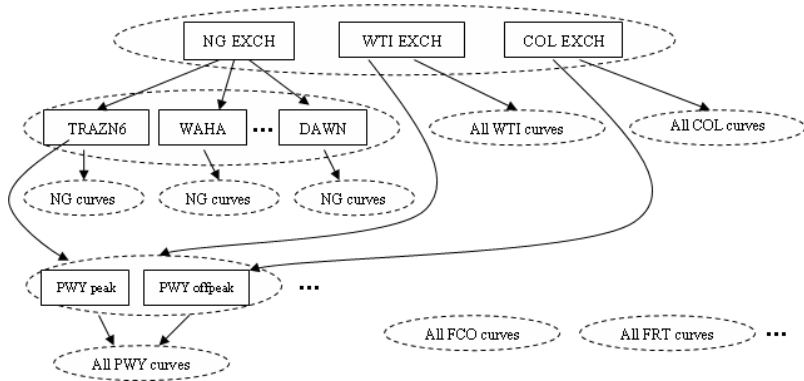
- Hand pick the parents (the representative/base curves).
- Natural Gas, Coal, Oil, International Coal.
- Many other markets that are quasi independent.
- Electricity and its dependency on fuels.

Example of the curve hierarchy

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Implementation decisions

We had to depart from the old simulation philosophy.

- We let the history speak. More price history is better. We want at least 3+ years. But we need clean data.
- We simulate only up to 4 years out. For contracts farther out, price changes are added on top of the current marks.
- This means that for a 10 year deal we're only going to show you the exposure for the next 4 years. We're not that infatuated to believe we can predict price ranges beyond 4 years without a fundamental model.
- The good news is that groups of curves, markets can have different models. So we can model the FRT & FRC curves separately.

Implementation decisions

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- Only linear deal type will be supported. No more heat rates, options, etc. It is simply not worth pursuing full valuation at this stage. And it will be a show stopper.
- Performance results:
 - 1000 simulations for all curves takes less then 2 hours.
 - Calculating the exposure for all counterparties is about 1 hour.
- The code was written in the Open Source statistical programming language R. No licenses issue. Ever.

Future steps

- Continue testing the model and make it production ready.
- We were setback when trying to add more historical data. We're almost done with that.
- We've build some backtesting facilities. Need to expand them.
- Integrate the R development with the Web interface.
- We have code ready to pull positions directly from calculators.
- We have code ready to calculate a Credit VaR using the Credit Risk+ method. Need data from RAFT to publicize this daily.

Only foreseeable risk is other assignments from Aram. In Jan-08, you should be able to use this new tool. John, Haibin, Jing and I will support you and all further development.

Future Future steps

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- Start adding full valuation capability (end of 2008).
- Investigate alternative models. Modeling volatility. Add the ability to add a “fundamental” view (trend).
- Other possible items.