Mortgage Securitization Meltdown: Analytical Failures and Proposals

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Where Are We?

- World financial markets have suffered very large, across-the-board declines in value
- Unprecedented declines in residential property values have been experienced in many countries
- The banking systems of most Western countries have been in complete disarray, requiring huge government interventions
- A global recession is ongoing, with large negative effects impacting employment, trade and government revenues
- Previously active markets in securitized debt, and related credit risk transfer instruments, have ground to a halt

How Did We Get Here

- While there are a myriad of "big picture" contributors to the current crisis, we will focus on particular failures in fixed income analysis that are the root of the problem
    - The BET and "Diversity Scoring" methods developed by Moody's to give credit ratings for securitized debt
    - Notching ratings as practiced by S&P and others
    - The Gaussian Copula method (Li 2000) for estimating credit risk of loan pools
    - Reliance on credit swap curve data to estimate credit risk correlations
    - Failure to incorporate market data on expectation for housing prices

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The Appetite for Risk

- Under the Basel II banking regulations, banks are required to have capital reserves against the risks decline in asset values, essentially controlling the degree of leverage in balance sheets
- Which of the following values is closest to the Basel II capital reserve requirement for a bank to hold securities rated AAA by any of the major rating agencies?
  - 8%
  - 4%
  - 1%
  - .25%

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Basel II Reserve Requirement

- The correct answer is .25%.
- The actual value is .56%, with an 8% reserve requirement and a 7% "at risk" rating
- Effectively banks can lever 178 to 1 on AAA rated securities
- Once a way was found to create AAA rated securities through securitization of lower rated debt, the global demand for AAA rated securities skyrocketed
- *The rating agencies, although private, profit making enterprises, effectively had global regulatory powers*

Start at the Beginning

- In the late 1990s, Moody's began to provide credit ratings of securitized corporate loans (CLO) based on a method known as the Binomial Expansion Technique

- Once a default probability had been estimated for loans in a pool, the probabilities of potential multiple defaults within the pool was based on simple binomial probability formulas that assumed that defaults would be fully independent across borrowers

- To account for the obvious flaw that defaults are likely to be correlated, Moody's introduced an adjustment called Diversity Scoring

- *In 1999, Northfield published a research paper criticizing BET and Diversity Scoring based on a client request*

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Moody's Diversity Scoring

- To account for default correlation, Diversity Scoring reduced the assumed number of issues in a loan pool

- For example, if you had 70 loans in a pool, you might count that as 40 independent loans

- Moody's broke firms into 32 industries
  - 2 credits in the same industry counted as 1.5
  - 10 credits in the same industry counted as 4

- Implicitly there is an assumption that defaults are correlated within industries, but never across industries
  - Completely ignores potential for pervasive effects of recession, war or other systemic influences

- Although Moody's largely abandoned BET in 2005, many institutions, such as AIG, continued to use the method

"The Secret Formula That Destroyed Wall Street"

- Cover story in WIRED magazine, March 2009

- Refers to the "Gaussian Copula" approach for estimating default risk across a pool of loans, from Li (2000)
  - Allows for closed form calculation of marginal risks as more and more loans are added to the pool to be securities
  - Requires an assumption of the expected correlation of defaults

- The problem is credit risky instruments have high skew in the payoff distribution, so the joint distribution will be Gaussian under the Central Limit Theorem only for very large numbers of independent events
  - Even a small degree of correlation calls the method into question

The Problem of Higher Order Dependence

- Imagine you want to allocate money to two hedge funds based on traditional MPT

- The two portfolio managers happen to have offices in the same building and meet for coffee every morning
  - During conversation, they flip a coin. If the coin comes up "heads" they hold the identical portfolio for that day. If it comes up "tails" they go long/short against each other

- If the coin is fair, the time series of their portfolio returns will be zero
  - It varies daily from +1 to -1, averaging zero

- Being independent implies zero correlation, but zero correlation does not imply independence

We Go Blindly Forward with the Gaussian Copula

- Investment banks love the Gaussian Copula because now you can get joint default probabilities over any number of loans with the estimation of a single number, the default correlation
  - The rating agencies such as Moody's and S&P go along and rate based on this method
- The problem is where to get the default correlation assumption, since actual defaults were rare events, so statistical estimation from historical data is questionable
- Bankers used observable correlations from changes in spreads in the credit default swap market

CDO/CDS Default Correlations

- Assessing default correlations from credit swap curves and CDO trading was horrendously faulty

- Once CDOs and CDO^2 could be written on "generic ABS" index results instead of specific pools, they were a form of legalized gambling

- The volumes in the CDO market were many times the volume of actual underlying loans against which to hedge credit risk, creating severe pricing distortions

- The CDO/CDS markets were dominated by a few large players, such as AIG, further distorting economic pricing relationships

The Emperor Had No Clothes

- In the 2002 documentation of their COSMOS fixed income risk model, Barra commented that the observed correlations between credit swap data and OAS spreads on actual bonds *appeared to be of the wrong sign*
  - "This (data in Table 7) appears to be evidence against the idea that the level of the swap curve is the primary determinant of yields of non-government bonds. ……….. This is contrary to the expectation that swap and bond spreads (to the government term structure) should be strongly positively correlated."
- Since 1999, Northfield's EE model was structured without any use of credit swap information
  - Relies entirely on individual OAS analysis on millions of issues over hundreds of fixed income categories

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When Money Is At Stake, Cheat!

- S&P has admitted to "notching" ratings on many securitized instruments

- If an issuer wanted a rating done in a hurry, S&P would simply assume a rating of one grade lower than whatever S&P or Moody's had most recently rated the debt of the same issuer

- To my mind, this is fraud
  - The expectations of financial market participants is that rating agencies actually conduct some form of credit analysis before issuing a rating
  - At a cocktail party, a securitization lawyer for S&P rebuked me, saying they had done nothing illegal, as there are no actual requirements for any analysis

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Bury Your Head in the Sand

- At the October 2007 Northfield conference, presenter Jonathan Reiss showed that the prices for house price futures contracts for some US cities (e.g. Miami) were trading at a 30% discount to current prices
  - How can lenders give out "no money down" mortgages when futures prices indicate expectations of dramatic price declines?
- Around the same time, Bob Glauber, interim chairman of Freddie Mac, asked their internal analysts for a "worst case scenario" on their portfolio
  - The analysts came back with a scenario of US average housing prices not rising for three years
  - He actually had to order them to consider the possibility for price declines. They got to only 4% a year for 3 years before giving up in horror at the projected financial outcomes

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Some Unpleasant Outcomes

- From the first quarter of 2005 through the third quarter of 2007, two thirds of CDOs S&P had rated were downgraded.
    - 44% of all CDOs were downgraded to "speculative" or "in default"

- Over the same time, 17% of sub-prime residential mortgage securities were downgraded
    - 9.8% were downgraded to "speculative" or "in default"

- $250 Billion in major bank write offs from January 1, 2007 through April 2008, another $500 Billion estimated from April 2008 to date

The Mark to Market Problem

- FASB 157 has recently been relaxed to reduce the "fire sale" aspect of liquidations and write downs at major institutions

- What most people are forgetting is that most bank assets are not subject to FASB 157

- Whole loans that are not securitized are not currently subject to mark to market
  - Subprime residential loans
  - Commercial real state loans
  - Current estimates are that 20% of American households have negative home equity, with some cities such as Las Vegas over 60%

A Quick Fix

- In 2004, Northfield introduced a real estate extension to our Everything, Everywhere model

- Within this methodology, we model the underlying economic activity in a given geographic area to estimate default risk and correlations

    - We measure economic activity as the fractions of total household income that arises from the various sectors of the economy (manufacturing, technology, energy, etc.)

    - Risks to household incomes are modeled as lagged cumulative stock market sector returns

    - If the banking sector is doing poorly, this will weaken New York and London, but less so Seattle, or Venice. If oil prices are up, things are good for Houston, Norway and the OPEC countries

- Given appropriate information on underlying loans, the expectation of default correlation can be directly calculated in Merton fashion

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Summing Up

- The global financial crisis has many contributing factors

- Many of these contributing factors were simply poor quantitative analysis in which mathematical convenience was allowed to take precedence over the conceptual rigor of the models

- The shortcomings in the analytical methods applied to the RMBS, CDO and CDS markets were easily observed by those who were relatively free of conflicts of interest

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