“Kill All The Quants”?: Models vs. Mania in the Current Financial Crisis

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Summary of the Crisis

What Happened?

- Late 1990’s: low interest rates, “ownership society”, housing boom
- Lots of mortgages issued due to ARMs, securitization, Fannie, Freddie
- Lots of investors holding MBS (thanks to AAA ratings and CDS)
- Many of these securities were leveraged (AAA ratings and CDS)
- 2004: interest rates rise; 2006: housing market declines, defaults begin
- Losses are magnified by securitization, leverage, illiquidity
- Securities are downgraded, collateral deteriorates, firesales
- Investors, dealers, insurers, originators, GSEs lose money
- Loss of confidence triggers further losses, downgrades, more firesales
- Leads to “death spirals”, reduction in credit, general flight to quality
- Regulators intervene to forestall even more serious repercussions

How Could This Have Happened To Us???
Summary of the Crisis

“Hall of Shame”?

- Homeowners
- Commercial banks
- Investment banks and other issuers of MBSs, CDOs, and CDSs
- Mortgage lenders, brokers, servicers, trustees
- Credit rating agencies (S&P, Moody, Fitch)
- Insurance companies ( multiline, monoline)
- Investors (hedge funds, pension funds, mutual funds, other institutions)
- Regulators (SEC, OCC, CFTC, Fed, etc.)
- Government sponsored enterprises
- Politicians

But What About The “Quants”?  Models vs. Mania
“Confessions of a Risk Manager” in *The Economist*, August 7, 2008:

Like most banks we owned a portfolio of different tranches of collateralised-debt obligations (CDOs), which are packages of asset-backed securities. Our business and risk strategy was to buy pools of assets, mainly bonds; warehouse them on our own balance-sheet and structure them into CDOs; and finally distribute them to end investors. **We were most eager to sell the non-investment-grade tranches, and our risk approvals were conditional on reducing these to zero.** We would allow positions of the top-rated AAA and super-senior (even better than AAA) tranches to be held on our own balance-sheet as the default risk was deemed to be well protected by all the lower tranches, which would have to absorb any prior losses.
“Confessions of a Risk Manager” in *The Economist*, August 7, 2008:

In May 2005 we held AAA tranches, expecting them to rise in value, and sold non-investment-grade tranches, expecting them to go down. From a risk-management point of view, this was perfect: have a long position in the low-risk asset, and a short one in the higher-risk one. But the reverse happened of what we had expected: AAA tranches went down in price and non-investment-grade tranches went up, resulting in losses as we marked the positions to market.

This was entirely counter-intuitive. Explanations of why this had happened were confusing and focused on complicated cross-correlations between tranches. In essence it turned out that there had been a short squeeze in non-investment-grade tranches, driving their prices up, and a general selling of all more senior structured tranches, even the very best AAA ones.
To get back to long-run average, we need a 45% real drop (= 35% nominal drop)

Summary of the Crisis

S&P/Case Shiller Composite 10 Home Price Index

- July 2006: 226.17
- July 1996: 78.10
- January 2009: 158.04
- November 2010: 142.00

Effective Fed Funds Rate
S&P/Case Shiller Composite 10
CME S&P/ICS Futures

Updated March 31, 2009

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Why Do Crises Happen In Other Industries?
Perrow’s (1984) Theory of “Normal Accidents”
- Two conditions:
  1. Complex system (nonlinearities)
  2. Tight coupling
- Examples: nuclear power plants, chemical plants, NASA
- We should **expect** large failures under these conditions
- We should **prepare** for such failures

How Complex Are CDO’s?
Just How Complex Are MBSs, CDOs, and CDSs?

- Many moving parts
  - ARMs
  - Caps
  - Penalties
  - Originator/lender
  - Other “features”
- Many parties
- Not much history
- Rapid growth

Step 1 - The Lender obtains a loan from a Lender. This may be done with the help from a Mortgage Broker. In many cases the Lender and the Mortgage Broker have no further interaction with the Borrower after the loan is made.

Step 2 - The Lender sells the loan to the Issuer and the Borrower begins making monthly payments to the Servicer.

Step 3 - The Issuer sells securities to the Investors. The Underwriter assists in the sale, the Rating Agency rates the securities, and Credit Enhancement may be obtained.

Step 4 - The Servicer collects monthly payments from the Borrower and remits payments to the Issuer. The Servicer and the Trustee manage delinquent loans according to terms set forth in the Pooling & Servicing Agreement.

HVB Asset Management Asia (HVBAM) has brought to market the first ever hybrid collateralized debt obligation (CDO) managed by an Asian collateral manager. The deal, on which HVB Asia (formerly known as HypoVereinsbank Asia) acted as lead manager and underwriter, is backed by $120 million of asset-backed securitization bonds and $880 million of credit default swaps. Under the structure of the transaction, Artemus Strategic Asian Credit Fund Limited—a special purpose vehicle registered in the Cayman Islands—issued $200 million of bonds to purchase the $120 million of cash bonds and deposit $80 million into the guaranteed investment contract, provided by AIG Financial Products. In addition, the issuer enters into credit default swap agreements with three counterparties (BNP Paribas, Deutsche Bank and JPMorgan) with a notional value of $880 million. On each interest payment date, the issuer, after payments of certain senior fees and expenses and the super senior swap premium, will use the remaining interest collections from the GIC accounts, the cash ABS bonds, the hedge agreements, and the CDS premiums from the CDS to pay investors in the CDO transaction. The transaction was split into five tranches, including an unrated $20 million junior piece to be retained by HVBAM. The $127 million of A-class notes have triple-A ratings from Fitch, Moody’s, and S&P, the 20 million B-notes were rated AA/Aa2/AA, the $20 million C bonds were rated A/A2/A, while the $13 million of D notes have ratings of BBB/Baa2 and BBB.

Complexity, Tight Coupling, and Human Behavior

\[ S[L] = \begin{cases} 
L & \text{when } L \leq K_{IRB} \\
K_{IRB} + K[L] - K[K_{IRB}] + (d \cdot K_{IRB} / \omega)(1 - e^{\omega(K_{IRB} - L)/K_{IRB}}) & \text{when } K_{IRB} < L 
\end{cases} \]

where

\[ h = (1 - K_{IRB} / LGD)^N \]
\[ c = K_{IRB} / (1 - h) \]
\[ v = (LGD - K_{IRB}) K_{IRB} + 0.25 (1 - LGD) K_{IRB} \]
\[ f = \left( \frac{v + K_{IRB}^2}{1 - h} - c^2 \right) + \frac{(1 - K_{IRB}) K_{IRB} - v}{(1 - h) c} \]
\[ g = \frac{(1 - c)c}{f} - 1 \]
\[ a = g \cdot c \]
\[ b = g \cdot (1 - c) \]
\[ d = 1 - (1 - h) \cdot (1 - Beta[K_{IRB}; a, b]) \]
\[ K[L] = (1 - h) \cdot ((1 - Beta[L; a, b]) L + Beta[L; a + 1, b] c). \]

Paragraph 624 of Basel II, June 2004, p. 132
Perrow’s (1984) Modified Theory of “Normal Accidents”

- Three conditions:
  1. Complex system (nonlinearities)
  2. Tight coupling
  3. Third condition (Lo, 2004): Absence of negative feedback over a period of time

Perrow Does Not Explain Why Such Accidents Are “Normal”

⇒ Human Behavior Is The Reason

- Investors
- Managers
- Legislators
- Regulators
Could The Crisis Have Been Avoided?
Could The Crisis Have Been Avoided?

What If We Knew This Was Going To Happen In 2005?

'Exuberance' -- again

Remember the stock bubble? Yale economist Robert Shiller, says we're just as mad for real estate.
January 25, 2005, 12:54 PM EST
By Robert J. Shiller

NEW YORK (MONEY Magazine) - Yale University economist Robert Shiller made one of the great calls in stock market history. His book 'Exuberance' hit the shelves in March 2006, the same month the tech stock bubble struck a sharp pin.

Timing helped turn 'Exuberance' into a bestseller, but Shiller had been predicting for several years that excessive speculation would prove a disaster for many investors.

A few days before Alan Greenspan famously used the phrase 'irrational exuberance' in a December 1996 speech, Shiller had been at lunch with the Fed chairman, arguing that the stock market was irrational and suggesting that Greenspan might have something to say about how overvalued it had become.

Shiller's first tome focused exclusively on the stock market. A substantially revised edition of 'Exuberance', to be published in April, includes a new chapter on what Shiller believes is the bubble in residential real estate.
Could The Crisis Have Been Avoided?

What If We Knew This Was Going To Happen In 2005?

ECONOMIC VIEW
MARK Gimenez

Is a Hedge Fund Shakeout Coming Soon? This Insider Thinks So

All the sectors of the financial universe, the hedge fund world is perhaps the most secretive and almost entirely the most alluring. Open only to institutions and the wealthy, hedge funds offer protected models of risk, access to the financial market, and the chance for outsized returns. According to Van Hedge Advisers, hedge fund assets have topped $2 trillion.

The downside, unfortunately, is that occasionally the industry may be subject to catastrophic and unanticipated losses. In 1973, for example, the top hedge fund managers lost their jobs and the Long Term Capital Management fund came close to collapse. Just last month, investors were reminded of exactly this kind of possibility with the apparent failure of a multibillion dollar hedge fund managed by the Bayou Group.

Andrew Lo, a finance professor at the Sloan School of Management at the Massachusetts Institute of Technology, has been studying hedge fund failures and risks, and he says that another hedge fund industry shakeout is likely in the near future. Mr. Lo, who runs a company, Alphridge, that manages a $100 million hedge fund—to me is not asking for a reason to say hedge funds are a threat. That is exactly what Mr. Lo is saying, backing it up with powerful data and a couple of anecdotes.

Mr. Lo has been working on the economics of hedge funds since the mid-1990s, but he started thinking seriously about how to measure risk across the industry in 1999. When he was first approached by backers to start a new hedge fund, he recognized that some hedge fund managers had no way to measure their fluctuations, and simply assumed that their values were going up steadily. To measure, he concluded, managers had to set a level of illustrative returns that were partially even. In those cases, he concluded, managers had no way to measure their fluctuations, and simply assumed that their values were going up steadily. He got an idea that hedge funds are safer, from growing that hedge funds are safer, may be a warning sign for the industry. (The paper is at http://work.mit.edu/ale/.)

That doesn’t necessarily hold true for every individual fund. As Mr. Lo says in his paper, the smoothness of returns gives economists a good way to estimate the level of relatively illiquid investments in hedge fund returns. The approach lets economists measure industry-wide liquidity risks without knowing the details. (The paper is at http://work.mit.edu/ale/.)

For Mr. Lo, the lesson from his research is that hedge funds are safer, from growing that hedge funds are safer, may be a warning sign for the industry. (The paper is at http://work.mit.edu/ale/) and that hedge funds just don’t give out.

Andrew W. Lo of MIT, says he has found warning signs for the hedge fund industry. His graduate students, have come to a disturbing conclusion that smooth returns, from growing that hedge funds are safer, may be a warning sign for the industry. (The paper is at http://work.mit.edu/ale/) and that hedge funds just don’t give out.

The New York Times, Sunday, September 4, 2005

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Could The Crisis Have Been Avoided?

What If We Knew This Was Going To Happen In 2005?

- Through what mechanism can this information be acted on?
  - As CEO, reduce business exposure ⇒ lose market share
  - As CRO, hedge exposure ⇒ lose money until 2007
  - As portfolio manager, turn away assets ⇒ lose key personnel

- Success and prosperity are potent anesthetics ("feeling no pain")
- But pain is necessary to guard against dangers
- Prolonged bull market dulls the sense of danger and risk aversion
- But why not exit when initial losses occur?
  - Historical data for real-estate markets suggested gradual decline
  - Ratings, CDS, and active markets gave false sense of security
  - Exit became impossible with leverage and illiquidity

⇒ Psychology of Greed Makes These Crises Unavoidable
Has This Happened Before?

Yes, Many Times (see Reinhart and Rogoff, 2008):

- 18 times since 1974
- 5 **big** bank-related crises:
  - 1977: Spain
  - 1987: Norway
  - 1991: Finland
  - 1991: Sweden
  - 1992: Japan
- Common themes:
  - Rising housing and stock markets
  - Capital inflows
  - Large public debt
  - Financial liberalization
Has This Happened Before?

Yes, Many Times (see Reinhart and Rogoff, 2008):

Real Housing Prices

Source: Reinhart and Rogoff (2008)
Has This Happened Before?

Yes, Many Times (see Reinhart and Rogoff, 2008):

Real Equity Prices

Source: Reinhart and Rogoff (2008)
Has This Happened Before?

Yes, Many Times (see Reinhart and Rogoff, 2008):

Public Debt as Share of GDP

Source: Reinhart and Rogoff (2008)
Has This Happened Before?

Yes, Many Times (see Reinhart and Rogoff, 2008):

Real GDP Per Capita

Source: Reinhart and Rogoff (2008)
Crisis Preparation vs. Crisis Prevention

- Break up banks and broker/dealers that are “too big to fail”
- Create exchanges for CDSs and other large OTC contracts
- Create financial NTSB for analyzing all blow-ups
- Require confidential disclosure regarding “network” exposures
- Implement counter-cyclical leverage constraints for bank-like entities
- Enforce “suitability” requirements for mortgage-broker advice
- Require certification for mgmt. and boards of complex financial institutions
- Impose more mark-to-market accounting and risk controls
- Impose capital adequacy requirements for all bank-like entities
- Create new discipline of “risk accounting”
- Impose small derivatives tax to fund financial engineering programs
- Revise laws to allow “pre-packaged” bankruptcies for finance companies
- Change corporate governance structure (compensation, CRO role, etc.)
- Teach economics, finance, and risk management in high school
## Crisis Preparation vs. Crisis Prevention

### MIT School of Engineering

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<th>Year</th>
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Conclusion

Over the Next Several Years, We Will Be Rebuilding Our Financial Infrastructure for the Next Century
Thank You!