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Smithson – Credit Portfolio Management, Chapter 1
The Revolution in Credit – Capital is the Key

I. Reviewer's Note: *This is a fairly old source but it has important implications for the recent credit meltdown. While it is difficult to assess the validity of after-the-fact analyses of what caused it, this source clearly indicates that regulators incited banks to extend credit to lower quality borrowers.*

II. THE CREDIT FUNCTION IS CHANGING

- a. Easy to recognize this by increasing growth in secondary loan trading, credit derivatives and loan securitization
- b. However, less apparent and more important is the philosophical change from 'originate and hold' to a portfolio approach to lending
- c. Banks Are Facing Higher Risks
 - i. Bank loan portfolios have increasing concentration on lesser creditworthy obligators
 1. Disintermediation led to better credits eschewing bank loans
 2. Regulatory rules incite banks to lend to lower quality credits
 3. Defaults in 2001-2 rose to levels not seen since the early 1990s
- d. Banks Are Earning Lower Returns
 - i. Especially on investment grade borrowers
 1. A third of banks surveyed said large corporate and middle market loans earn a positive return, but do not add shareholder value (i.e. do not return the COC)
 - a. Used to establish/maintain relationship
 2. 29% said the same except that loans were a loss leader
 3. Only 24% said they add shareholder value
 4. ROEs in the US were 12%, 16.5% in Eurasia
- e. Banks Are Adopting a Portfolio Approach
 - i. 90% plan to sell their loans and 95% have created a credit portfolio management function
 1. Plan to hold 7-10% of loans originated
 - ii. Doing this to increase shareholder value
 - iii. Banks are not far along in their plans to adopting this approach
 1. Still have a traditional structure

III. CAPITAL IS THE KEY

- a. Regulators and banks both view capital similarly, with the important difference that regulators prefer more capital to protect depositors and the guarantee funds while banks recognize capital as the scarce resource
- b. Relevant Measures of Capital
 - i. Equity capital – residual claim on the bank's cash flows
 1. Shareholder's equity and retained earnings
 - ii. Regulatory capital – RBC under the Capital Accord as amended from time to time
 1. Equity capital plus some long term debt
 - iii. Economic Capital – based on the risk of the assets
 1. Resources needed to meet unexpected losses

IV. ECONOMIC CAPITAL

- a. Economic Capital Relative to Expected Loss and Unexpected Loss
 - i. Two concepts are important to know (see exhibit 1.3):
 1. Expected loss – mean losses
 - a. Long tail means mean is not centered on distribution
 - b. Not a risk, a cost of doing business
 - i. Covered by general reserves
 - ii. Priced in the transaction
 2. Unexpected loss – dispersion of loss distribution around its mean
 - a. Statistically the variance or standard deviation
 - b. The risk of doing business, not the cost
 - i. Covered by economic capital
 - ii. Only the cost of renting the capital needed for this risk is priced in the transaction
 3. From Unexpected Loss to Capital
 - a. Start with a target insolvency rate that must be converted to a capital number
 - i. Many banks use 0.03% - the probability of default on an AA security
 - ii. It would be easy if losses were normally distributed
 1. 1% target insolvency would be the mean plus 2.33 standard deviations
 2. Use statistics to calculate the 99.97% confidence interval
 - iii. Since we have a fat tail distribution, it's more difficult
 1. Most banks use Monte Carlo so you can plot the distribution and measure the tail risk directly

V. REGULATORY CAPITAL

- a. Banking regulation has been toward increasing and changing loan portfolio management practices
- b. 1988 Capital Accord
 - i. The first step – a crude one
 1. $\text{Capital} = \text{Risk Weight} \times \text{Exposure} \times 8\%$
 - a. Exposure varied by instrument, RW by obligator
 - ii. Criticized as being inconsistent, ignoring diversification and inflexible in recognizing improved models
 - iii. Encouraged lending to lower quality borrowers and under pricing commercial paper backstop facilities
- c. The 1996 Market Risk Amendment to the Capital Accord
 - i. Introduced the Internal Models Approach, which allowed the use of a bank's internal market risk measurement model
- d. Attempts to Fit Credit Derivatives into the 1988 Accord
 - i. Regulators allowed two very different approaches for the same risk based on whether they were interpreted as credit or derivatives
 1. Derivatives had much less regulatory capital attached than credit
 - ii. In the end, agreed to vary treatment depending on whether the risk resided in the Banking vs. Trading Book of the bank
- e. The 1999 Consultative Document
 - i. Broadened the focus from minimum regulatory capital requirements by adding a supervisory review and disclosure – three pillars

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- f. Proposed New Accord - January, 2001
 - i. Pillar 1 – minimum regulatory capital – 3 risk categories
 - 1. Market risk
 - 2. Operational risk
 - 3. Credit risk – 3 approaches
 - a. Revised Standardized Approach
 - i. Similar to the 1988 Accord, but risk weights based on external credit ratings
 - ii. Improvement is clear vis-à-vis 1988 Accord
 - 1. Eliminates OECD club preference
 - 2. Provides greater differentiation for corporate credits
 - 3. Introduces higher risk categories
 - 4. Adds option to allow higher risk weights for equities
 - b. 2 Internal Ratings- Based Approaches
 - i. Foundation and Advanced
 - 1. Differences are subtle – supervisor (regulator) provides some of the Risk Weights in the foundation approach
 - ii. Risk Weights are a function of the type of exposure and four variables
 - 1. Probability of default – PD
 - 2. Loss given default – LGD
 - 3. Maturity – M
 - 4. Exposure at Default – EAD
 - iii. Need to first calculate a benchmark risk weight – BRW – based on three year exposure
 - 1. This formula seems arbitrary, but actually reflects the credit portfolio model in the January, 2001 consultative document, adjusted for a three year horizon and normalized so the BRW is 100% when the PD is 70 bps
 - iv. Finally there are formulas for the foundation and advanced approaches (see p. 21)
 - 1. Advanced formula adds additional factor to foundation formula

Samad-Khan – Why COSO is Flawed

- I. Reviewer's note: *As I read this piece, I was reminded of an early experience as CFO when I was developing annual audit plans with the internal auditors. They developed a comprehensive program to assess every possible operational risk in every department and an elaborate schedule to ensure each area would be audited periodically. The resources needed to perform these audits far outstripped the company's ability to pay for them and by taking a comprehensive approach, high risk areas were not identified until after issues had arisen.*
- II. The author of this article is very opinionated and direct
- a. He presents his opinions as facts in many cases
 - b. His support for an actuarial process is laudable
- III. Operational risk is significant for company's operating in the global economy
- a. Benefits of a successful operational risk management (ORM) program improve financial performance and enhance shareholder value
 - i. Lower costs from losses or fixing problems
 - ii. Increased customer and employee satisfaction
 - b. BASEL II forced banks to review their operational risk management programs but most leading banks did not need to be told what to do, rather *how* to do it
 - i. Benefits are not clear to all banks, however
 - ii. Most that want an operational risk management program, want it based on a sound framework
 - iii. No dominant design for this framework has emerged over many years
 1. Opinions shape the debate vs. facts
 - a. People don't understand true meaning of modern ORM
 - i. They believe that following the Committee for Sponsoring Organizations of the Treadway Commission (COSO) approach is appropriate
 1. COSO framework leads to a process
 - a. Identify, define and assess all risks in each business' process
 - b. Define responses or controls to mitigate risks that threaten an organization's meeting its objectives
 - c. Involves creation of an audit trail of issues and action plans
 2. Appears logical and sound at macro level
 - a. Does not work in practice
 - i. Definition of risk is inconsistent with that used in RM industry and BIS
 - ii. Method is overly simplistic, highly subjective and conceptually flawed
 - b. COSO approach actually obscures risk
 - i. If you can't identify risks at the beginning of the process, these errors will permeate and ruin the entire process and its results
 - ii. Recommended risk mitigation strategies will be non-optimal
 - iii. Could even lead to increased controls over already over-controlled areas while ignoring areas with major control weaknesses
 3. COSO is wholly inappropriate for managing operational risk
 - a. It's resource intensive because all processes must be assessed at least annually to determine their dynamic risk level

- b. Risk information is collected from business managers who may not understand the relative probability of the risk events they identify
 - i. Only way to identify real risks is by studying historical loss data
 - ii. Need a risk manager to assess full range of potential risks
 - iii. Should start with the risk manger, not the business manager
- 4. COSO leads to trying to prioritize thousands of risks across the organization, which is difficult
 - a. COSO developed a 'likelihood/impact' method to assess risk
 - i. $\text{Likelihood} \times \text{impact} = \text{risk}$
 - ii. Problem is that it highlights high impact/high probability events when it is low probability/high impact events that define true risks
 - iii. High impact/high probability events are nonexistent – the company would have been destroyed by now if they did – this is a false positive
 - iv. Low probability/high impact risks show up as moderate risks – this is a false negative
 - b. Some say that this problem only exists at high levels and disappears when more granular analysis is undertaken
 - i. Example of risk associated with car accident shows that there are infinite endpoints to analyze and since the product of two figures close to the mean (medium impact/medium probability) is greater than the product at the extremes (high impact/low probability or low impact/high probability), true risk is obscured in the process because the extreme event is the one that is truly risky
 - c. If we then took a weighted average of all risk/impact combinations, it would represent a probability-weighted severity, but this is closely related to mean severity – or expected losses
 - i. BIS and risk management practices define operational risk as **unexpected** losses, not expected losses
- 5. The question COSO asks – find the product of impact and likelihood is flawed and leads to a calculation of mean severity, not unexpected loss
 - a. Should take all likelihood/impact combinations and develop a severity distribution to tell us the breadth of a potential loss, given one has occurred
 - b. Also need a frequency distribution to tell us the probability of a loss occurring
 - c. Can calculate the expected loss – the total amount one expects to lose each year on average and the unexpected loss – the amount you could lose in a very bad year in excess of the average (at some confidence interval)
- c. The effective modern risk management framework provides reliable information to key decision-makers so they are aware of their most significant risks and the quality of their corresponding controls
 - i. This allows them to make educated decisions when developing risk management, mitigation and transfer strategies

- ii. Managing operational risk entails optimizing the risk-control relationship in the context of cost-benefit analysis
 - 1. This requires a process to measure/monitor each business' changing risk and control profile
 - a. Four goals to accomplish this:
 - i. Risk management department must provide managers with objective information to help them understand where the risks are
 - 1. Not ask them to guess
 - ii. Must help managers understand how well existing controls help manage the real risks so they can tell where they are over or under controlled
 - 1. Cannot have a zero tolerance policy toward operational risk
 - iii. Must determine what level of controls is appropriate after analyzing costs/benefits of each risk mitigation/transfer strategy
 - iv. Must institute a comprehensive and transparent monitoring and reporting process
 - 2. The above are fundamental – best practices call for an integrated risk measurement/management program using objective, normalized measures to identify risk levels and internal control quality
 - a. Must have reliable information :
 - i. internal and external loss data
 - ii. theoretically valid risk assessment/measurement
 - iii. objective control assessment
 - iv. validated risk indicators
 - v. appropriate follow-up action
 - vi. disciplined scenario analysis
 - vii. solid VAR calculations
 - iii. This is both do-able and practical if the underlying framework is sound and the issues are understood

IV. Conclusions

- a. COSO was conceived in the early 1990s and was best practice at that time
 - i. With the advent of actual loss data becoming available, at BIS' insistence, better, more scientific approaches were developed
 - ii. Some argue that COS is useful because it can improve business process management
 - 1. This is not optimal operational risk management, however
- b. Some wrongly say risk measurement is separate from risk management – it's not
- c. Basel II was introduced to encourage banks to improve operational risk management
 - i. Following COSO does not accomplish this
 - 1. It encourages phantom risk management and does more harm than good
 - 2. Companies using this COSO approach will be signaling regulators that they are clueless
- d. Many so-called experts in operational risk management are really not knowledgeable of the new processes and can do more harm than good
 - i. Leads to wasted resources with no appreciable benefits
- e. No shortcuts to developing state of the art operational risk management systems
 - i. A bad system is worse than no system
 - ii. One bad loss is more costly than what it takes to develop an effective system
- f. Operational risk management industry is plagued with misinformation
- g. Better to find the right questions than pretend you have all the right answers

Brunnermeier – Deciphering the Liquidity and Credit Crunch 2007-2008

- I. Reviewer's note: *This paper is a detailed recitation of the events leading up to the credit crisis fueled by the subprime mortgage meltdown. It is quite thorough in its recitation of the events and explanations. It is amazing that many needed remedies were eschewed initially by financial institutions in fear of perceived negative reactions of the investment community. The author is less clear in explaining the link between the events and explanations and his conclusions and recommendations.*

II. Introduction

- i. Financial market turmoil in 2007-8 led to the most severe financial crisis since the Great Depression
 1. Housing bubble burst, forcing banks to write off/down hundreds of billions of bad loans
 - a. Market cap of banks also fell precipitously
 - b. This is dwarfed by the \$8 trillion of market value losses in the US stock markets
 - ii. This paper describes why the causes of the mortgage disruptions turned into broader financial market declines and the common economic threads that explain the market declines, loss of liquidity, defaults, etc. that occurred after the crisis
 1. Factors leading up to the housing bubble
 - a. Low interest rate environment
 - i. Influx of foreign capital from Asian countries
 1. As a hedge against their currency devaluing
 2. Kept exchange rates at a level where their exports were cheap
 - ii. Fed had a lax interest rate policy
 1. Feared deflation
 - b. Traditional banking model changed from originate and hold mortgages to originate and distribute model
 - i. Loans are pooled, tranced and securitized
 1. Securities are sold, many to foreign investors
 2. Three parts of this paper
 - a. Describe how the trend towards originate and distribute led to relaxed lending standards
 - i. Instead of increasing stability through the break up and distribution of risk to those entities best able to bear it, these financial innovations led to credit expansions and a boom in housing prices
 - b. Present a logbook of events in the financial markets turmoil of 2007-8, ending with the coordinated international bailout in October 2008
 - c. Four mechanisms that amplified the mortgage crisis into a full scale financial crisis
 - i. Borrowers' balance sheet effects cause two liquidity spirals
 1. Asset prices fall, eroding capital
 2. Lending standards tighten
 3. This turns into a spiral of dropping prices leading to tighter standards, which then leads to lower prices and the cycle begins anew
 - ii. Then the lending channel dries up even for the creditworthy as banks hoard funds because they fear they can't access capital markets

- iii. Runs on financial institutions ensue which erode bank capital suddenly
- iv. Network effects arise when financial institutions are borrowers and lenders at the same time
 - 1. Exacerbated when multiple trading parties fail to cancel out offsetting positions because of concerns about counterparty credit risk, causing gridlock and forcing banks to hold additional funds to protect against the risks that aren't hedged

III. Banking Industry Trends Leading Up to the Liquidity Squeeze

- a. Move to originate and distribute versus holding originated mortgages
 - i. Securitization: Credit protection, Pooling and Tranching Risk
 - 1. Banks offload risk through the creation of structured products called collateralized debt obligations (CDOs)
 - a. First, form a diversified portfolio of mortgages and other loans, bonds and assets (credit card receivables)
 - b. Next, slice them into tranches, with varying risk
 - i. Safest tranche is the super senior tranche, offering relatively low interest rates, but early repayment of principal
 - ii. Most junior and risky tranche is the equity tranche or toxic waste, which is paid only after all other tranches are paid
 - iii. Other tranches are in between those two
 - c. Then sell the tranches to different investors
 - 2. Buyers of these tranches can protect themselves by also purchasing credit default swaps (CDS), which insure against the default of a particular tranche
 - a. Pay a fixed fee in exchange for a payment contingent upon a credit default
 - i. Estimated \$45-62 trillion outstanding in 2007
 - ii. Can also trade indices consisting of credit default swaps
 - b. Buyers of AAA rates tranches backed by CDS were confident that their risk was small
- b. Banks financed assets with shorter maturity instruments
 - i. Banks are now heavily exposed to the risk of a dry up in funding liquidity
 - ii. Short assets are preferred by investors, because they allow withdrawal at short notice if needed
 - 1. Also can be used to pressure banks with the threat of withdrawal
 - 2. May be used to signal confidence in their ability to perform
 - iii. Yet most investment projects/mortgages have longer maturities – so banks financed long term loans with short maturity deposits
 - 1. A clear mismatch
 - iv. Same mismatch occurred in the shadow banking system that consisted of off-balance-sheet (OBS) investments
 - 1. Short term commercial paper was backed by long term assets
 - a. These assets could be seized upon default
 - b. What if the owner chose not to continue buying the short term paper
 - i. OBS structures could not roll over their debt
 - 1. But banks often granted credit lines to these OBS vehicles – called liquidity backstops
 - a. Subjects the bank to funding liquidity risk even though these structures are not on their balance sheet

- v. Investment banks' balance sheets also trended to a mismatch by financing their balance sheets with short-term repurchase agreements (repos)
 - 1. Sell asset today while promising to repurchase it later
 - 2. Overnight repos doubled from 2000 to 2007
 - a. Financing rolled over every day
- vi. Liquidity backstops and overnight repos created severe maturity mismatches for banks
- c. Rise in Popularity of Securitized and Structured Products
 - i. Positives
 - 1. Cater to needs of different investors
 - 2. Shifts risk to those who want to bear it
 - 3. Allows for lower mortgage rates and interest rates on corporate debt
 - 4. Allows institutions to hold assets that they were once barred from holding
 - a. Example – an AAA tranche carved out of a BBB mortgage pool
 - ii. But most of the credit risk never left the banking system
 - 1. It was passed among commercial and investment banks, suggesting perhaps commission income was the motivator behind the growth of this asset class
 - a. Author is purposefully vague on motive
 - iii. Clearly, regulatory and ratings arbitrage was available and aided their popularity
 - 1. Basel I required capital was 8% of loans, but far less for lines of credit
 - a. No capital charge for reputational credit lines – the noncontractual liquidity backstops
 - b. Banks could lower capital requirements by moving a pool of loans to off balance sheet vehicles and then grant a LOC to that pool ensure it an AAA rating
 - i. But risk was the same
 - 2. Basel II attempted to correct this by varying charges based on asset ratings
 - a. Had little effect as the pools of assets received credit for diversification and had higher ratings than the individual securities in the pools
 - b. Further, issuing short term assets improved the rating even more because there was not sufficient downgrades for granting liquidity backstops
 - iv. Statistical models of investors and ratings agencies were overly optimistic about these products
 - 1. Their models were based on historically low default/delinquency rates
 - a. Housing prices had not fallen nationwide since WWII, only regional declines were observed
 - i. Models assumed low cross-regional correlation in housing prices led to belief in geographic diversification
 - 1. Boosted valuations for AAA tranches especially
 - 2. Ratings agencies
 - a. RAs collected higher fees for rating structured products
 - b. Rating at the edge also contributed
 - i. Unlike AAA bonds, which may exhibit default risk from near zero to marginal AAA levels, the structured products were sliced to produce a minimum risk just below the line between AAA and AA
 - 3. Investors
 - a. Sought higher yields associated with structured products and believed risk of catastrophic loss to be small
 - b. Some preferred the relatively illiquid junior tranches because they traded infrequently and were hard to value
 - i. Could smooth returns by choosing date to revalue the portfolio

- d. Consequences: Cheap Credit and the Housing Boom
 - i. Rise in securitized products led to a flood of cheap credit and lowered lending standards
 - 1. Since others held the bag ultimately, originating banks only worried about pipeline risk, the risk of default in the few months they held the mortgage
 - a. Credit quality fell with this important underwriting step being compromised at the beginning of the chain
 - i. Teaser rates, no documentation mortgages, piggyback mortgages (combination of two loans that eliminates the need for a down payment) and NINJAs (No Income, No Job or Assets) became prevalent
 - ii. Since it was a given that housing prices could only rise, it was assumed that borrowers could later refinance using the increased value of the house
 - ii. Cheap credit and low standards fueled the housing frenzy that sowed the seeds of crisis
 - 1. Those that foresaw the liquidity bubble or credit bubble in 2007 were reluctant to bet against the market
 - a. This willingness to ride the wave, combined with the vulnerability of banks to reduced funding liquidity ultimately caused the crisis in 2007

IV. The Unfolding of the Crisis: Event Logbook

- a. The Subprime Mortgage Crisis
 - i. Triggering the crisis was increased subprime mortgage defaults, first noted in February, 2007
 - 1. January 2007 credit default ABX index for subprime nosedived, driving the cost of insuring a pool of these mortgages up
 - a. Investor pays an upfront fee of 100-ABX index to insure against default
 - ii. By May, UBS shut down its internal hedge fund after \$125mm of losses and Moody's put 62 tranches across 21 US subprime deals on downgrade review
 - 1. Mortgage related products' prices fell
 - iii. June and July brought more downgrades by Moody's, Fitch and S&P, further unnerving the market
 - 1. Bear Stearns injected \$3.2 billion into two of its hedge funds to meet margin calls
 - 2. Countrywide Financial reported lower earnings, new home sales declined year-over-year and the biggest US home builder reported a loss
 - a. Trend of declining house prices and sales would continue through late 2008
- b. Asset-Backed Commercial Paper (ABCP)
 - i. In July 2007, the market for short term asset backed commercial paper began to dry up due to erosion of investor confidence in ratings agencies and valuation issues for structured products
 - 1. Non-asset-backed securities were unaffected
 - 2. IKB, a small German bank was the first affected when it could not roll over their ABCP or provide a credit line and a 3.5B euro rescue package was announced
 - ii. In August, American Home Loan Mortgage Investment Corp. went bankrupt and BNP Paribas (French bank) froze redemptions for three funds, citing inability to value structured products
 - 1. Money market participants became reluctant to lend money
- c. The LIBOR, Repo, and Federal Funds Markets
 - i. These markets are also used by banks to finance themselves
 - 1. TED spread – the difference between risky LIBOR and risk-free treasuries, which had fallen to historically low levels during the liquidity bubble, spiked
 - a. Uncertainty drives investors to charge more for risk (LIBOR up) and bid up prices of risk-free bonds (Treasury yield down)

- d. Central Banks Step Forward
 - i. The European Central Bank/the US Federal Reserve injected 95B euro/\$24B in early August to stem the freezing of the interbank market, brought on by losses suffered by large quantitative hedge funds which increased the perceived risk of banks and hence LIBOR
 - 1. Fed also reduced the discount rate by 50 bps to 5.75%, broadened the type of collateral banks could post, and lengthened its lending horizon to 30 days on August 17th
 - a. But banks tend not to borrow at the Fed's discount window due to negative perceptions of doing so
 - i. Fed soon after lowered the discount rate another 50 bps to 5.25% and the FFR to 4.75%
 - 2. Northern Rock (UK bank) was felled by a bank run, an event that had last occurred in the UK over a century prior
- e. Continuing Write-downs of Mortgage-related Securities (October - December 2007)
 - i. October write-downs were perceived to cleanse banks' balance sheets and the Fed's injections of liquidity appeared to be effective
 - 1. More than \$38 billion of equity injected into banks
 - ii. But November saw upward revisions of previous estimates of \$200 B total mortgage loss, leading to more write-downs
 - 1. TED spread widened and the Fed cut the FFR by 25 bps in response
 - a. But FFR and discount rate cuts were not reaching affected banks so Fed set up a Term Auction Facility in December
 - i. Allowed banks to bid anonymously so they could accomplish the same effect as borrowing at the Fed discount window without the associated negative stigma
- f. The Monoline Insurers (January-February 2008)
 - i. Insurers who had traditionally insured muni bonds against default became the focus of worried investors because they were thinly capitalized and had extended guarantees to MBS and other structured products
 - 1. Downgrading the monolines would eliminate the AAA-rated insurance which asset underwriters require to deliver on their pledge to money market funds to buy back any assets if necessary at par
 - a. No AAA rating on these assets and the MM funds would be forced to sell them at a loss
 - 2. On January 19, Fitch downgraded monoline AMBAC, triggering a worldwide equity sell off that ranged from 5-15% loss of equity values over a few days
 - a. Fed then cut the FFR by 75 bps to 3.5% -an emergency cut
 - i. At their regular meeting on January 30, they cut the FFR by an additional 50 bps
- g. Bear Stearns (March 2008)
 - i. Pressured by increased spreads between agency bonds (Freddie and Fannie Mae) and treasuries widened, which hurt Carlyle Capital (hedge fund heavily invested in agency bonds), which couldn't meet its margin calls and was partially liquidated, which depressed the agency paper Bear held
 - 1. Bear was also a Carlyle creditor
 - ii. When the Fed set up a \$200B Term Securities Lending Facility to allow investment banks to temporarily and anonymously swap agency bonds for treasuries, some market players interpreted this as a sign that the Fed felt an investment bank would fail and concluded the troubled bank was the smallest and most leveraged – Bear Stearns

- iii. There was a timing foul up which made it appear that Goldman had no confidence in Bear, which led to a run on Bear by hedge fund clients and counterparties
 - 1. Bear was closed out of the repo market
- iv. Bear was deemed to interconnected to fail because it had over 150mm trades outstanding so the Federal Reserve Bank of NY brokered a deal where Chase would buy Bear for \$10 per share, about 7% of what it traded for the previous year
 - 1. Fed also cut the discount rate 25 bps to 3.25% and opened its discount window to investment banks, which temporarily eased liquidity problems for investment banks
- h. Government-Sponsored Enterprises: Fannie Mae and Freddie Mac
 - i. By June, spreads between agency bonds and treasuries widened again
 - ii. Fannie and Freddie were publicly-traded, government sponsored entities that securitized a large portion of US mortgages and had outstanding over \$1.5 trillion of bonds
 - iii. After a large private mortgage broker went under FDIC conservatorship, these GSEs were pressured and ultimately put into conservatorship in September amid falling stock prices and despite Treasury Secy. Paulson's announced plans to make the implicit guarantee of Fannie and Freddie explicit (as was always the case with the other GSE, Ginnie Mae)
 - 1. Conservatorship was a credit event for many credit default swaps, triggering large payments to those who bought them
- i. Lehman Brothers, Merrill Lynch and AIG (September 2008)
 - i. Lehman barely survived March 2008 and subsequently used the Fed's Primary Dealer Credit Facility but did not raise new equity because it feared the negative perceptions associated with being the only bank to do so
 - ii. Lehman's stock price continued to fall and when it became clear that the Korea Development Bank was not going to buy Lehman, its stock price plunged.
 - 1. Then-president of the NY Fed, Tim Geithner, tried to work a deal to secure Lehman, but no one would buy it without a government guarantee
 - a. Not forthcoming since Lehman, its clients and counterparties had opportunities to avoid the crisis
 - i. So Lehman declared bankruptcy
- iii. Merrill, seeing the handwriting on the wall, sold itself to Bank of America for \$50B
- iv. Before Lehman's failure could affect markets, AIG disclosed it had liquidity problems due to its increasing activity in credit default swaps (CDS), which triggered a 90% decline in its stock price
 - 1. Because of its interconnectedness in credit derivatives, the Fed arranged an \$85B bailout in exchange for 80% of the company
 - a. Another \$37B/40B was infused in October/November
 - 2. Lehman's demise caused unforeseen effects
 - a. Money market funds suffered losses, which caused some asset values to fall below \$1 or forced asset injections to stave off this breaking of the buck
 - i. US Treasury set up an \$80B guarantee for brokers' money market funds
 - ii. Price of CDS increased
 - iii. Financial non-asset-backed commercial paper prices fell, prompting the Fed to start a Commercial Paper Funding Facility

- j. Coordinated Bailout, Stock Market Decline, Washington Mutual, Wachovia and Citibank
 - i. Credit markets continued to deteriorate in October 2008, as seen by a spike in the TED spread
 - ii. Washington Mutual suffered a silent run on the bank as depositors withdrew their monies electronically
 - 1. FDIC placed it in receivership and it was ultimately sold to JP Morgan Chase
 - a. FDIC also facilitated sale of Wachovia to Citibank, but it ultimately went to a higher bidder – Wells Fargo
 - iii. Stock markets shed \$8 trillion since the October 2007 peak and credit markets tightened
 - iv. A \$700B bailout, including foreclosure mitigation, troubled asset purchases and forced recapitalization of banks was announced by Treasury
 - 1. Still Citibank needed more infusions in November and several more facilities were established to allow the Fed to buy commercial paper and almost any asset backed security/agency's paper
 - a. By December 2008, the Fed's balance sheet was \$2.3 trillion, up from 1.2 trillion in late 2007
 - i. The Fed also set its target interest rate between 0 and 0.25%

V. Amplifying Mechanisms and Recurring Themes

- a. Liquidity – or lack thereof – was the key to financial shocks turning into a full blown crisis
 - i. Liquidity dries up when frictions (reviewers note: typically friction refers to intermediaries in between the two ultimate parties in a transaction) limit optimal risk sharing and hinder the flow of funds to expert investors
 - 1. So assets are not resident with those with expertise to handle them
 - ii. Definition: Funding liquidity – the ease in which expert investors can obtain funding from financiers (who may be less informed)
 - 1. Leveraged traders buy an asset and then borrow short term against it (use it as collateral)
 - a. Can only borrow a portion of the value – the difference between an asset's price and its value as collateral is the margin or haircut
 - i. Margin is financed by the trader's equity
 - ii. Margin can change daily as market conditions change
 - b. Why do the traders engage in this risky business of financing long term assets with short term debt?
 - i. Costs more to raise long term capital (equity or long term debt)
 - 1. Even worse when there is a debt overhang problem and most new equity proceeds go to paying off debt holders, leaving little to invest on behalf of equity players
 - c. Outcome is that traders carry little excess capital and must de-leverage (i.e. sell assets) when margins/haircuts are increased
 - iii. Financial institutions that rely on short term/commercial paper or repos must roll over their debt frequently
 - 1. If they cannot – e.g. the commercial paper market dries up and no one will lend – effectively margins rise to 100%
 - a. Alternatively withdrawals or capital redemptions from an investment fund do the same thing
 - 2. Three types of funding liquidity risk
 - a. Margin/haircut funding risk – risk that margins increase
 - b. Rollover risk – risk that short term borrowing will be unavailable or increase in cost

- c. Redemption risk – risk that demand depositors of banks or equity holders of hedge funds will withdraw funds
 - d. Issues arise only when market liquidity is low and assets are worth cents on the dollar
- iv. Definition: Market liquidity – the ease in which assets can be sold to raise money (presumably at a price close to the purchase price)
 - 1. Market liquidity is low when selling the asset depresses the sale price
 - a. One trader may move the price a little, but large price drops occur when lots of traders try to exit an asset all at once
 - 2. Three types of market liquidity
 - a. Bid-ask spread – how much a trader loses if they sold at bid price and bought back at ask price
 - b. Market depth – how many units can be sold without moving the price
 - c. Market resiliency – how long it will take for prices to recover after they have fallen temporarily
- v. Market liquidity refers to transferring the asset and its associated cash flow while funding liquidity is like issuing debt/equity supported by the cash flow generated by an asset or trading strategy
 - 1. Liquidity and potential for financial crisis is affected by the interaction of funding liquidity and market liquidity acting through *mechanisms* that amplify the initial shock
- b. Borrower's Balance Sheet Effects: Loss Spiral and Margin Spiral (affects leveraged investors)
 - i. *Loss spiral* is when a decline in asset value erodes an investor's net worth much faster than its gross worth due to leverage and the amount they can borrow falls
 - 1. Example given is a \$100mm asset leveraged at 10 to one – 10mm equity and 90mm debt
 - a. \$5mm (5%) loss in value to 95 erodes equity value by 50%, forcing sale of 45mm to maintain leverage ratio
 - i. Sale of this amount depresses sale price, which starts the cycle all over again as price of remaining 50mm falls, inducing more selling
 - 1. Exacerbated by potential buyers holding off on purchases as they wait for asset prices to bottom out or predatory practices by other traders who want to force others to liquidate at fire-sale prices
 - ii. *Margin/haircut spiral* reinforces the loss spiral because as margins rise, the investor must reduce the leverage ratio
 - 1. Margins rise in times of large price drops, tightening lending and leading to further problems
 - a. Higher margins force more deleveraging/sales that increase margins and force more sales
 - 2. Shouldn't margins **decrease** after liquidity-driven price reductions as these are likely temporary and a great buying opportunity? No
 - a. Unexpected price shocks suggest more future volatility, driving margins/haircuts higher
 - b. Asymmetric-information frictions emerge as financiers worry that remaining assets aren't saleable and are not good collateral
 - c. Naively estimating future volatility using past data will suggest higher volatility as price drops

3. Individual investors can rationalize holding leveraged positions backed by asset-liability maturity mismatches by assuming future prices will be stable
 - a. This failure to realize that unloading their assets might trigger others to do likewise is why bank regulation is necessary
4. The loss spiral is more pronounced for stocks with low liquidity and structured products have very low liquidity
 - a. Since trades are few, selling in a crisis environment would force marking the remaining assets at the low price
 - i. So investors sell assets with higher market liquidity first
- iii. Lending Channel – lenders have limited capital and restrict lending as their financial situation worsens
 1. *Moral hazard* arises when the net worth of the intermediaries' stake falls and the intermediary may reduce monitoring the borrower's investment decisions
 2. *Precautionary hoarding* is when lenders fear that interim shocks will reduce capital for their own projects and strategies
 - a. Increases when likelihood of shocks increase and outside funds are expected to be limited
 - b. This is what drove LIBOR spikes in 2007-8
- iv. *Runs on Financial Institutions*
 1. Before deposit insurance, getting your money out of troubled banks first was incented
 - a. Late movers would risk getting haircut
 - i. Fundamental problems – bank invested in bad projects – asset values wouldn't support payouts
 - ii. Funding-liquidity problems – early withdrawals force fire-sale liquidation of long maturity assets and erosion of bank wealth
 - b. Motivation to preempt others would be socially inefficient (author's term for a bad thing for society)
 2. Deposit insurance eliminated runs on banks but not runs on other institutions
 - a. Not rolling commercial paper is a run on the issuer of asset-backed commercial paper
 - b. Bear Stearns experienced a run when hedge funds pulled their dollars from them
 - c. AIG also when counterparties requested additional capital for its CDS
 - d. Problem extends beyond debt holders to equity holders of hedge funds or mutual funds
 - i. Early mover advantage arises because fund managers sell liquid assets first
 1. NAV will fall after fund's cash and liquid assets are exhausted
- v. *Network Effects: Counterparty Credit Risk and Gridlock Risk*
 1. Need to realize that most financial institutions are borrowers and lenders at the same time, which complicates matters
 2. Using the Bear Stearns crisis as an example, suppose a hedge fund has an interest rate swap with Goldman that is offset by another swap with Bear Stearns
 - a. These positions are essentially a single swap between Goldman and Bear
 - i. If Goldman feared Bear would default, it would not renew the contract
 1. Goldman's delay in march 2008 was misinterpreted as exactly that and contributed to the run on Bear

- b. Extending this example to include the impact of counterparty credit risk, suppose Bear had an offsetting swap agreement with a private equity fund, which offset its exposure with Goldman (see figure 5 on p. 98)
 - i. All positions are hedged but parties are only aware of their own contracts and may become concerned about counterparty credit risk
 1. Say the investment banks refused to let the hedge fund and private equity fund net/cancel their positions
 - a. Both funds would have to put up additional capital or insure against counterparty credit risk by buying CDS
 - i. Which may drive up the price of CDS
 - ii. Which actually happened to Lehman and AIG
3. If there was a central authority or clearinghouse that knows who owes what to whom, multilateral netting agreements can stabilize the system
 - a. But given most transactions are OTC, with the increased opaqueness contributing to increased systemic risk

VI. Conclusion

- a. In 2007, falling housing prices led to increased mortgage delinquencies
 - i. This triggered a full blown liquidity crisis which still exists today
- b. This crisis resembles a classic bank run, but is different due to the extent of securitization, which created an opaque web of interconnected obligations
 - i. The mechanisms which exacerbated the crisis should be the basis for thinking about a new financial architecture
 1. For example, author feels that financial institutions have incentives to take on too much leverage, to have excessive mismatch in asset-liability maturities and to be too interconnected
 - a. Future regulation should take this into account

VII. Problems

- a. Assume a \$150mm hedge fund levered at 15 to 1 (140mm debt and 10mm equity).
 - i. How far would prices need to fall to wipe out the value of the equity?
 1. Answer: 10mm or 6.67%
 - ii. If the fund needs to maintain the 15 to 1 ratio, what would it do if it couldn't raise more capital?
 1. Answer: Sell 9.33mm of invested assets
 - a. Assets now 130.67, equity now 9.33mm
 - iii. After that, assume prices fall again, this time by 5%. What is the impact on capital and what would the fund do to maintain the ratio if it couldn't raise capital?
 1. Answer: Assets now 124.14, equity is 2.8mm
 - a. Fund must sell 6.07mm of investments to replenish capital
 - iv. Why would investors be reluctant to contribute equity to this fund at this time?
 1. Answer: They may be reluctant to invest because prices are falling or because they want to force the fund to continue to sell off and depress prices further before they buy.