GLOBAL FINANCIAL CRISIS OF 2007-09

ANATOMY AND LESSONS FOR ECONOMIC AND REGULATORY POLICY

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Pakistan Institute of Development Economics - PIDE

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GLOBAL FINANCIAL CRISIS

ANATOMY OF FINANCIAL MELTDOWN

Epicenter of Crisis
US Sub-prime Mortgage Market

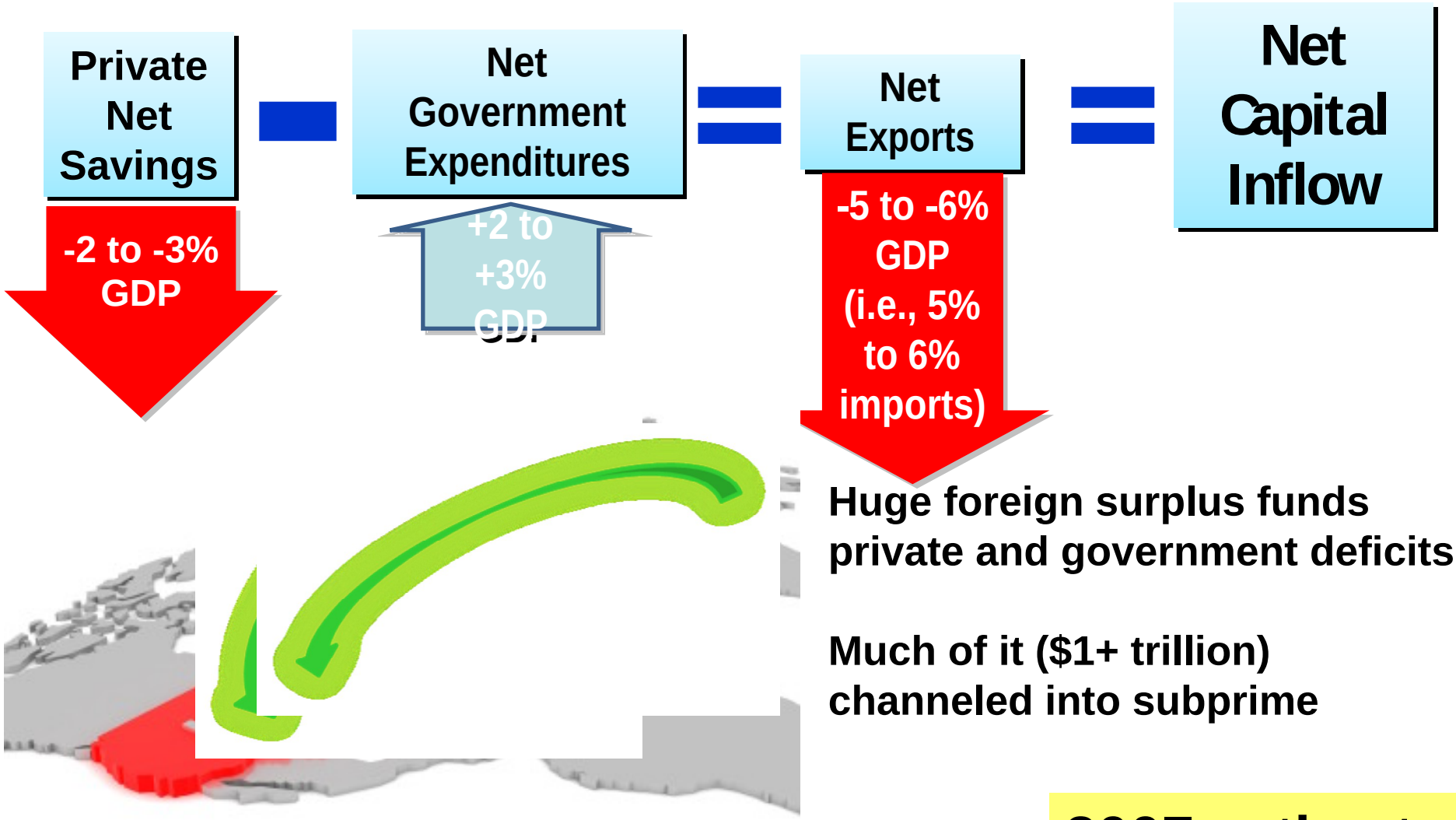
- “the most dangerous financial shock in mature financial markets since the 1930s.”- IMF World Economic Outlook (Oct. 2008)
- Alan Greenspan recently called it a “once-in-a-century credit tsunami”, born of a collapse deep inside the US housing sector.
- “100 year flood”

The Biggest Bubble in History

A Special Report released in 2005 by The Economist noted:

"The total value of residential property in developed economies rose by more than $30 trillion over the past five years, to over $70 trillion, an increase equivalent to 100% of those countries' combined GDPs. Not only does this dwarf any previous house-price boom, it is larger than the global stock market bubble in the late 1990s (an increase over five years of 80% of GDP) or America's stock market bubble in the late 1920s (55% of GDP). In other words, it looks like the biggest bubble in history."

“Debt-fueled US households went on an unparalleled spending binge by dipping into their housing ‘piggy banks’”
… Martin Wolf

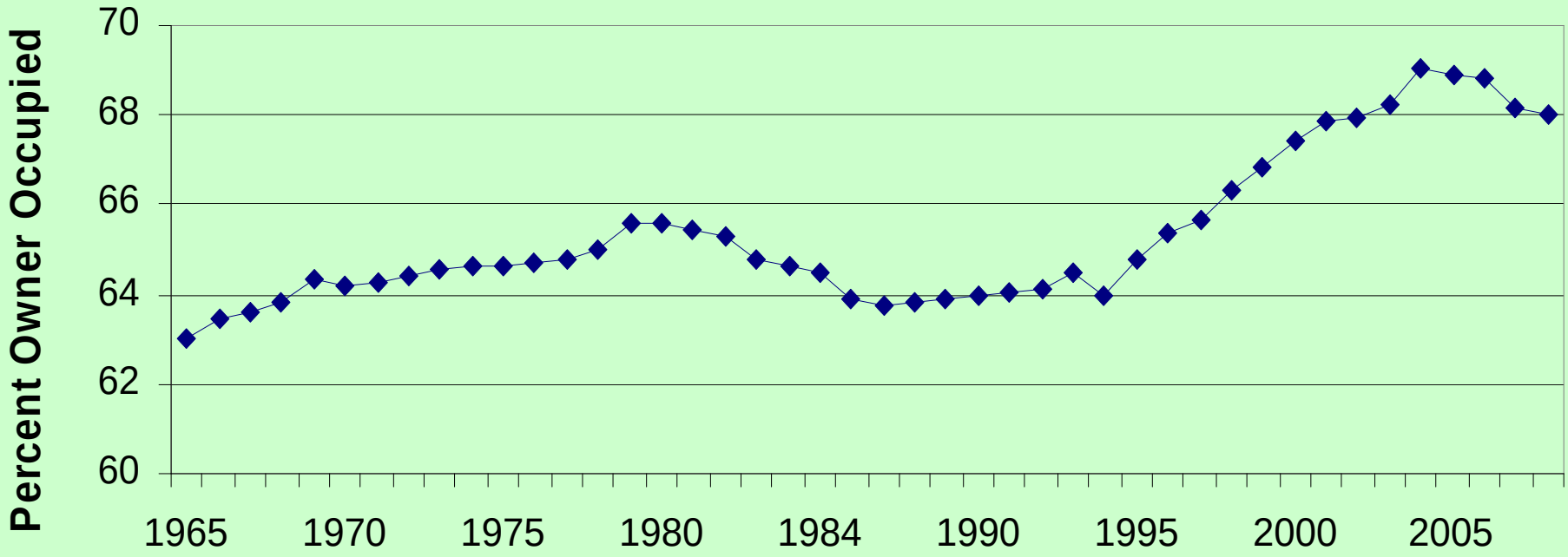


Huge foreign surplus funds private and government deficits

Much of it ($1+ trillion) channeled into subprime

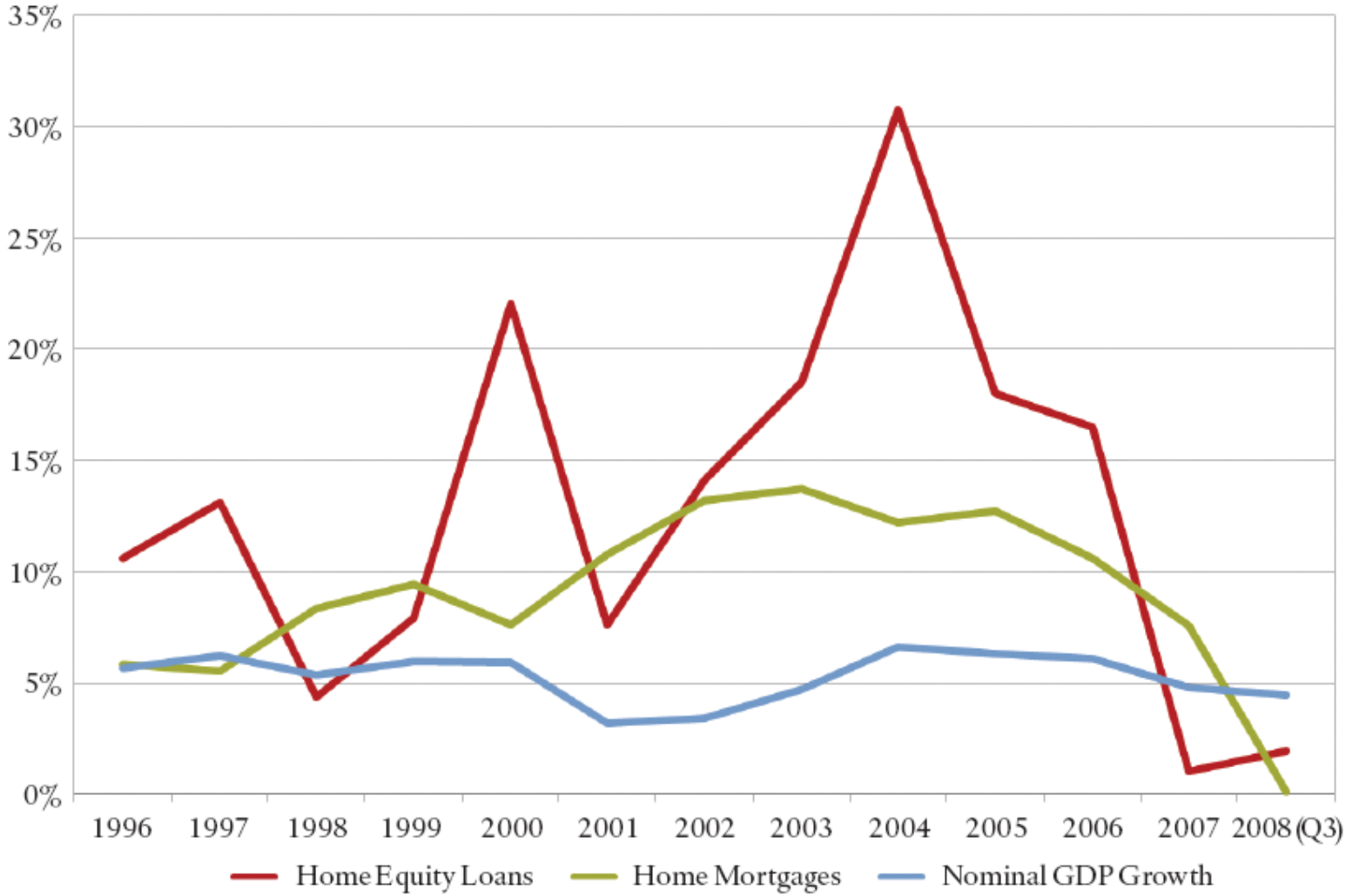
2007 estimates

Home Ownership

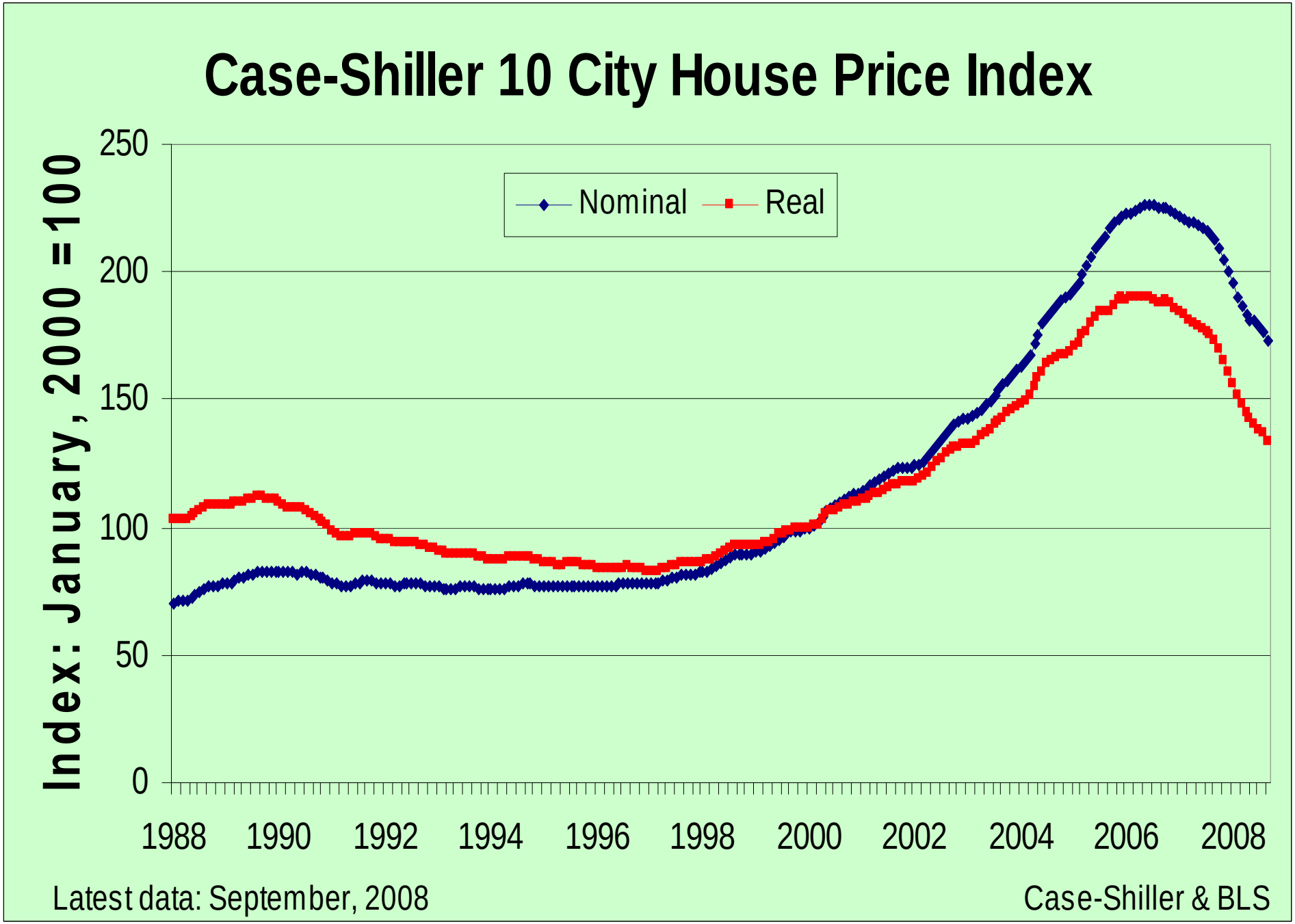


Bureau of the Census, CPS, Series H-111

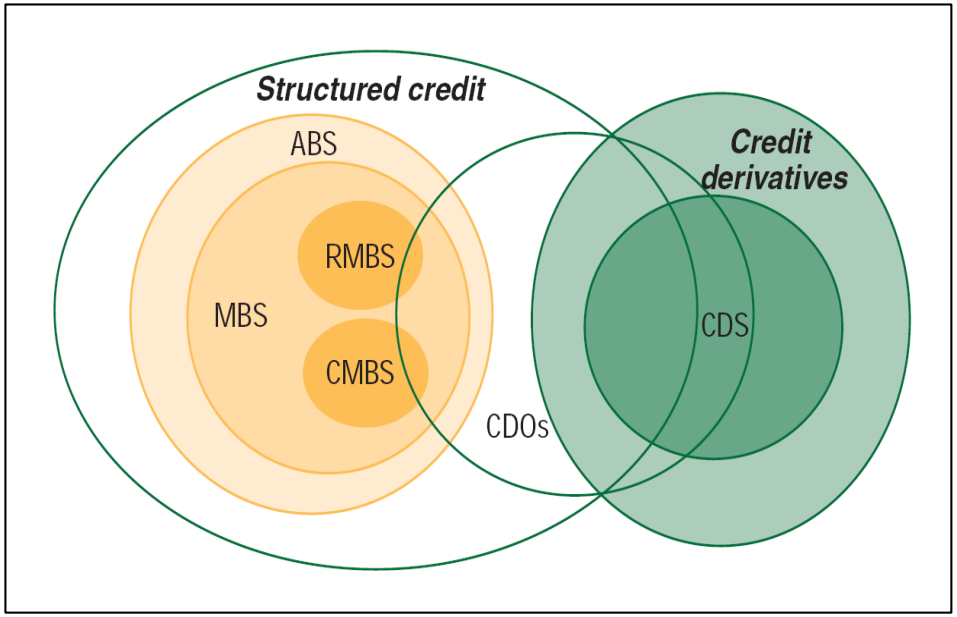
FIGURE 2. ANNUAL U.S. HOME LOAN GROWTH VS. NOMINAL GDP GROWTH



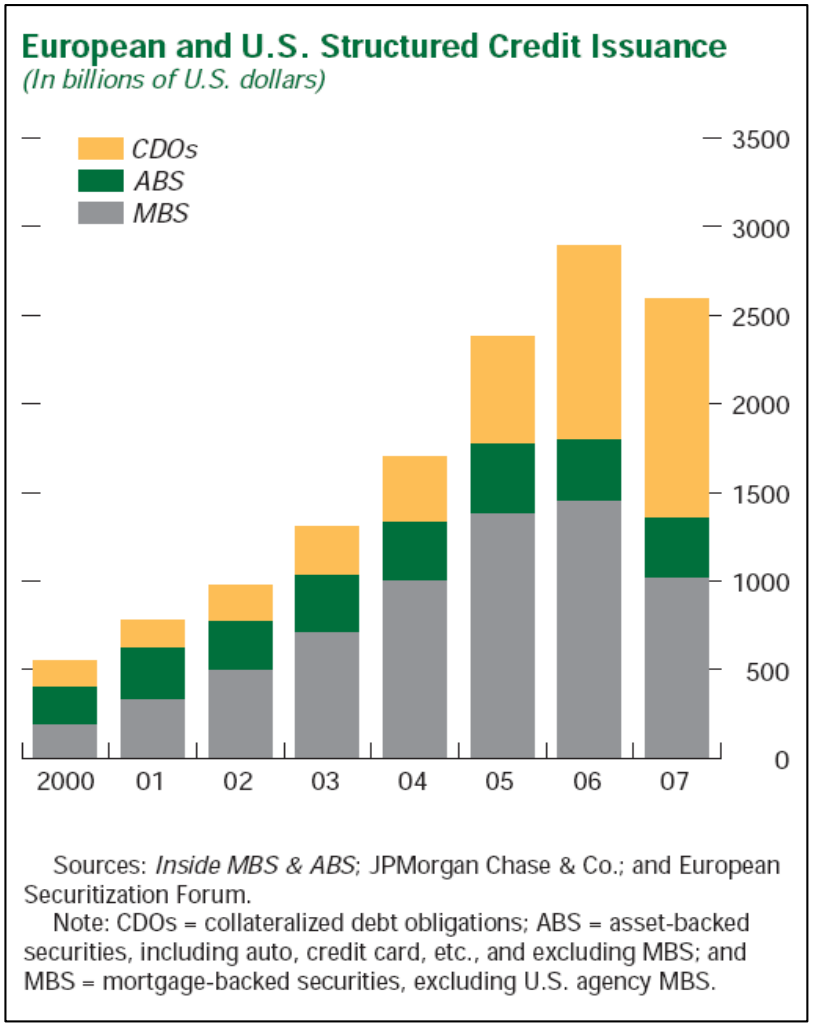
Data Source: Federal Reserve Flow of Funds.


Case-Shiller 10 City House Price Index
Index: January, 2000 =100
250
200
150
100
50
0
Nominal
Real
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
Latest data: September, 2008
Case-Shiller & BLS

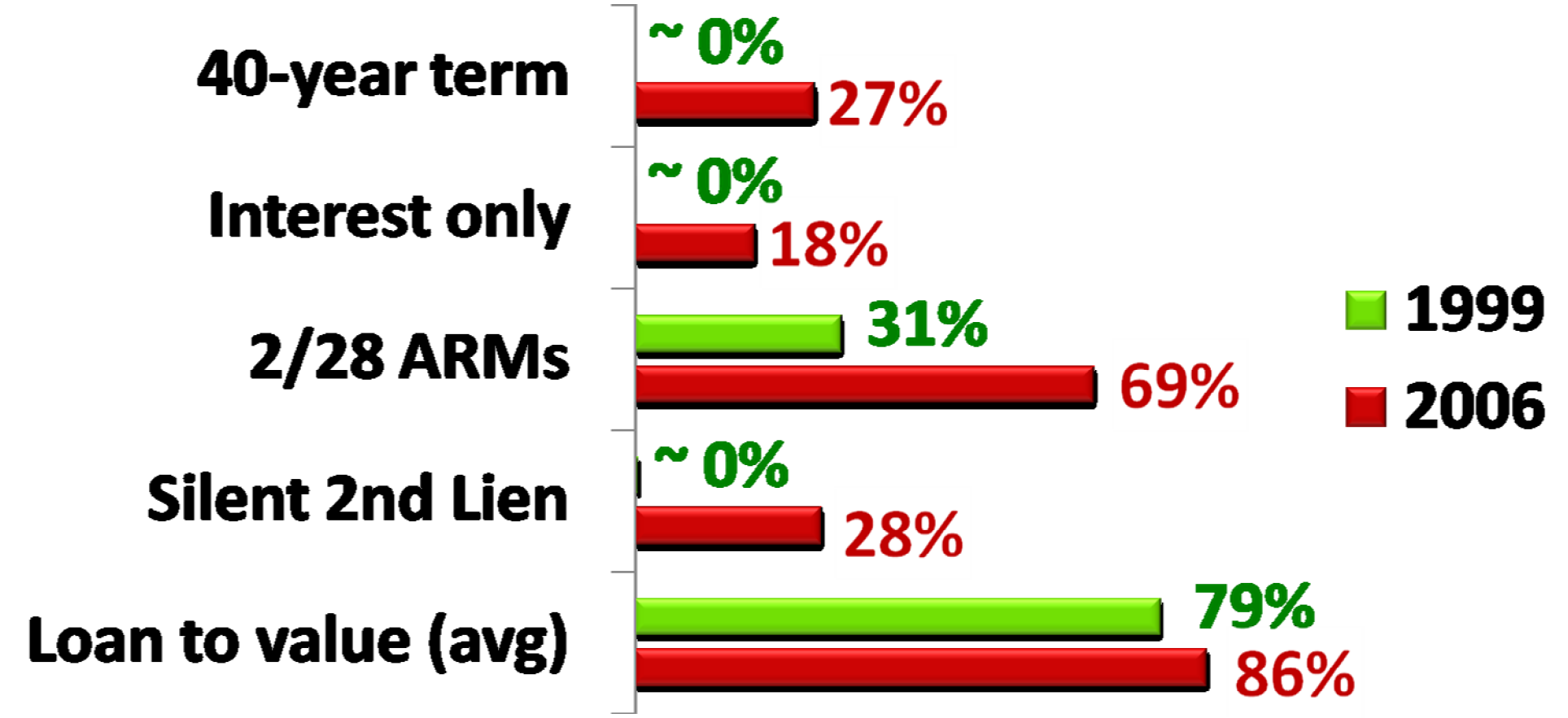
Structured Finance Instruments

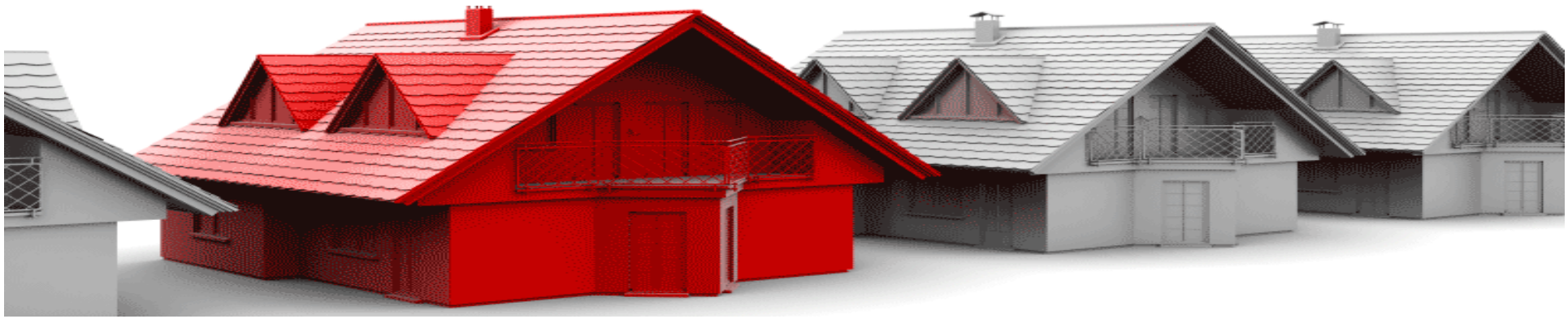


- RMBS – residential mortgage backed securities
- CMBS – commercial mortgage backed securities
- MBS – mortgage backed securities
- ABS – asset backed securities
- CDO – collateralized debt obligations
- CDS – credit default swaps



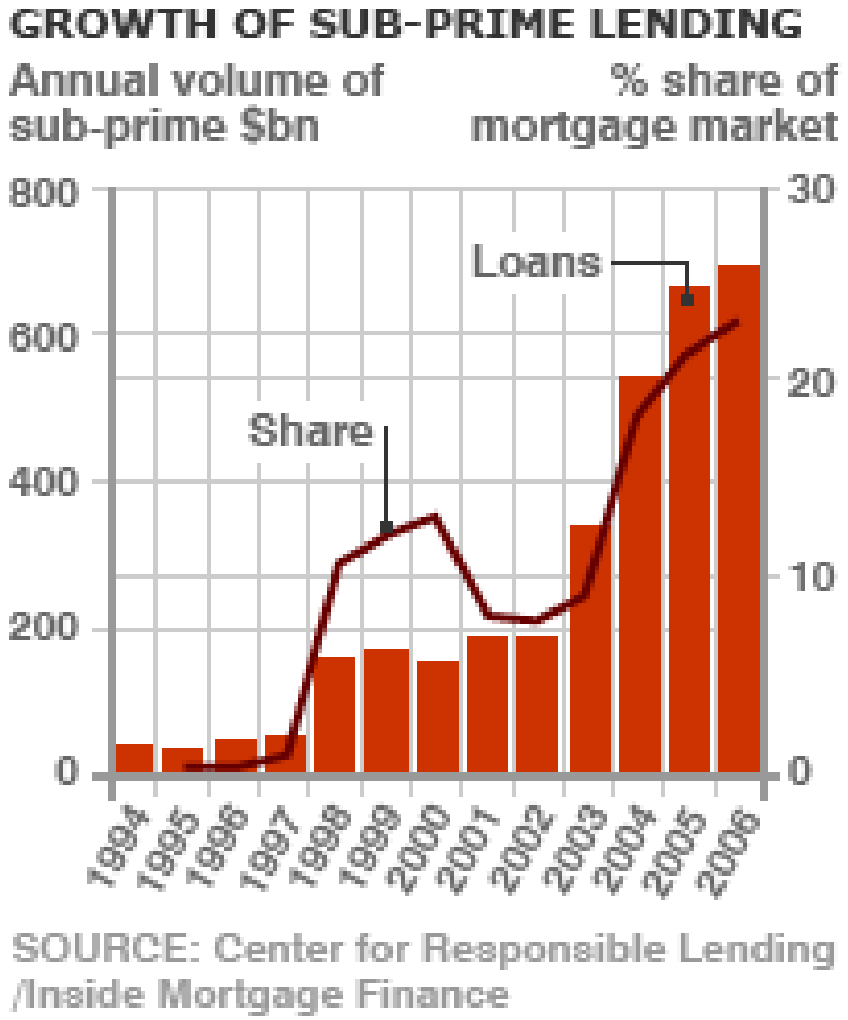
Subprime loans in MBS Pools





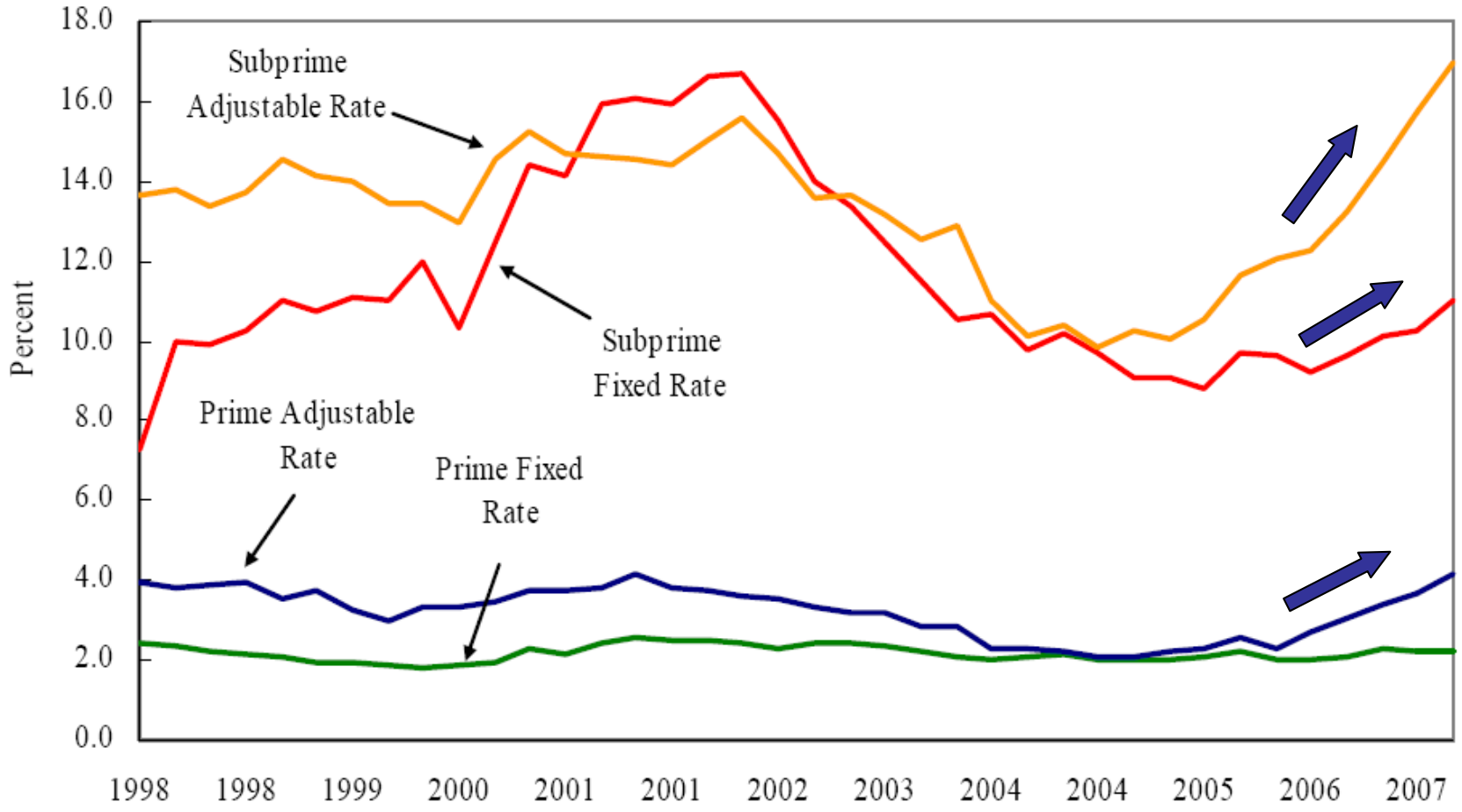
Sub-prime Lending

- By 2005 one in five mortgages were sub-prime.
- Most of these mortgages were adjustable rate mortgages (ARMs), thus were much riskier. The payments were fixed for two years, but linked to Fed interest rates, which also rose substantially.
- These had a much higher rate of repossession than conventional mortgages



Rising Loan Defaults

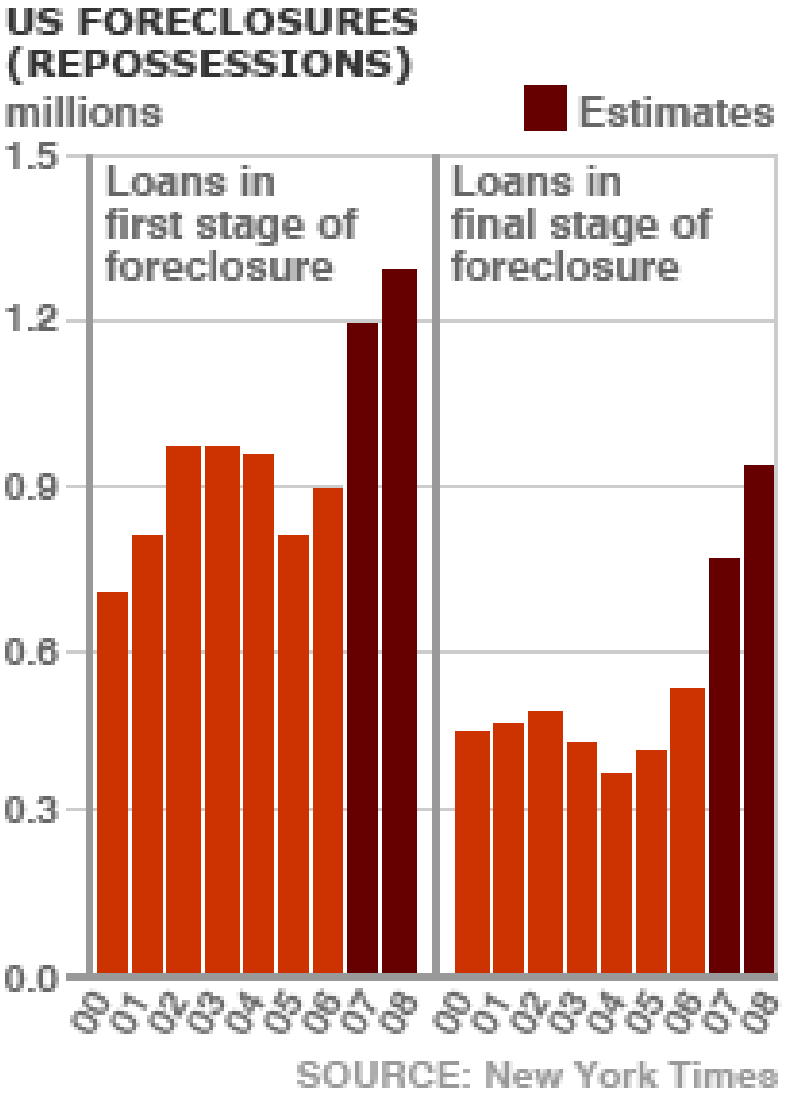
Figure 11: Comparison of Prime Versus Subprime Delinquency Rates, Total US 1998-2007



Sources: Mortgage Bankers Association.

Sub-prime Defaults

- A wave of repossessions swept America as many of these mortgages reset to higher rates. By late 2007, one in ten homes in Cleveland had been repossessed and Deutsche Bank Trust, acting for of bondholders, was the largest property owner in the city.
- As many as two million families are in danger of eviction from their homes.



Main Themes

Three systemic reasons for the crisis:

1. Complexity
2. Risk Management
3. Perverse Incentives

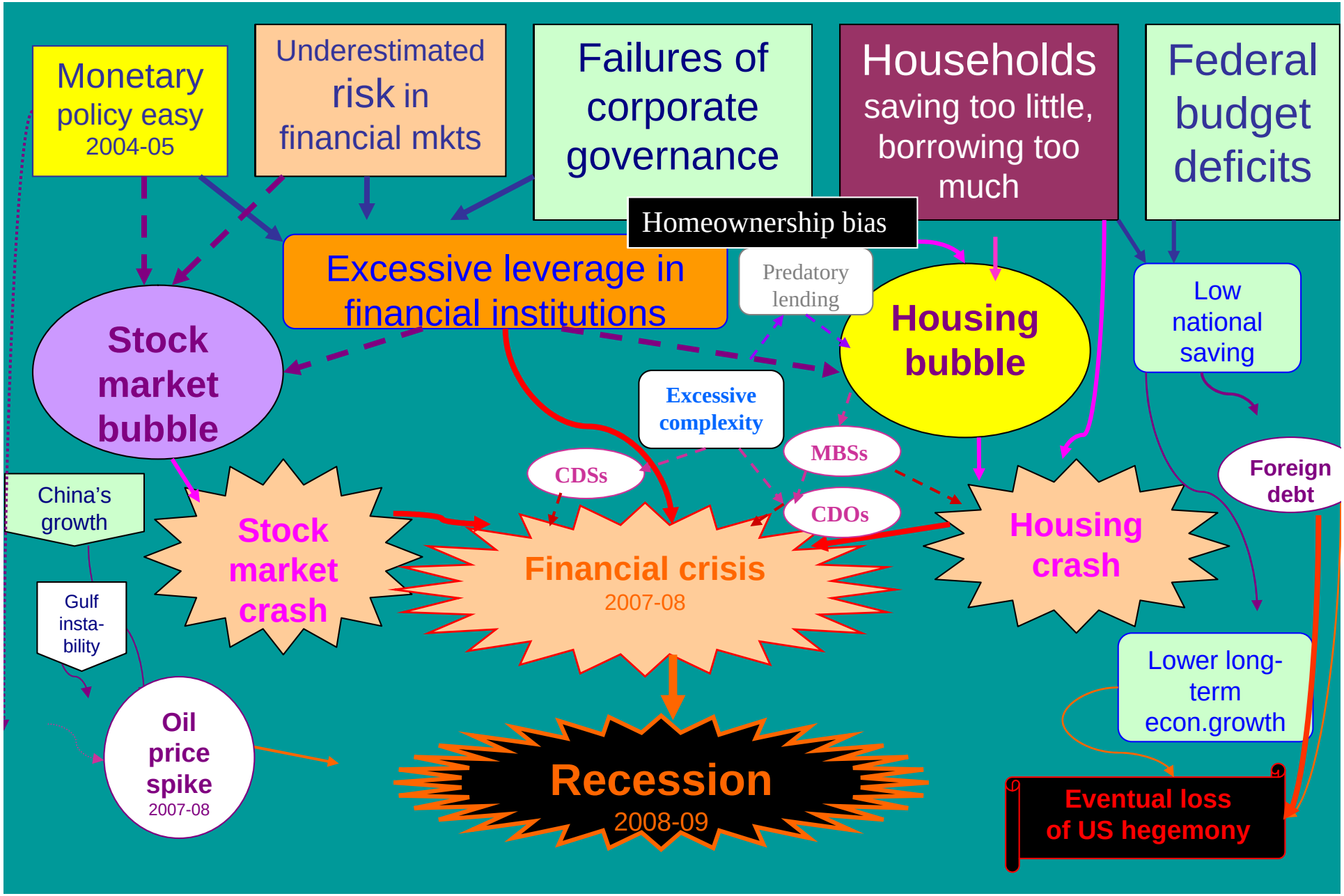
COMPLEXITY

- Complexity is one of the biggest problems of the financial markets
- INTERACTIVE COMPLEXITY:
  - A complex system with components that interact in unexpected ways
- THE PROBLEM IS WHEN SOMETHING IS BOTH INTERACTIVELY COMPLEX AND TIGHTLY COUPLED

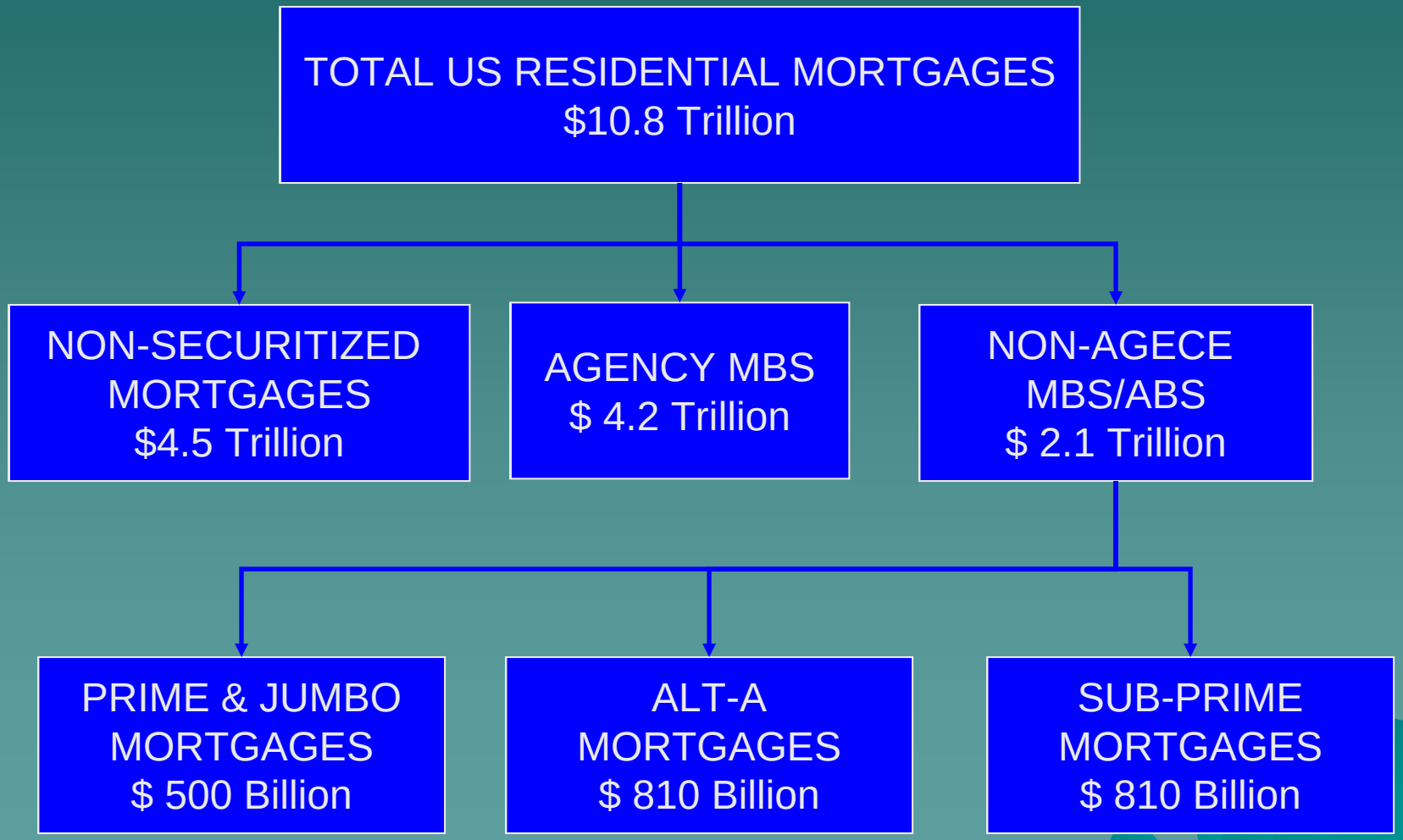
Sources of Complexity

- Structure of the US mortgage markets
- Originate and Distribute Model
- Securitization – MBS
- CDO's, CDS's and CDO2

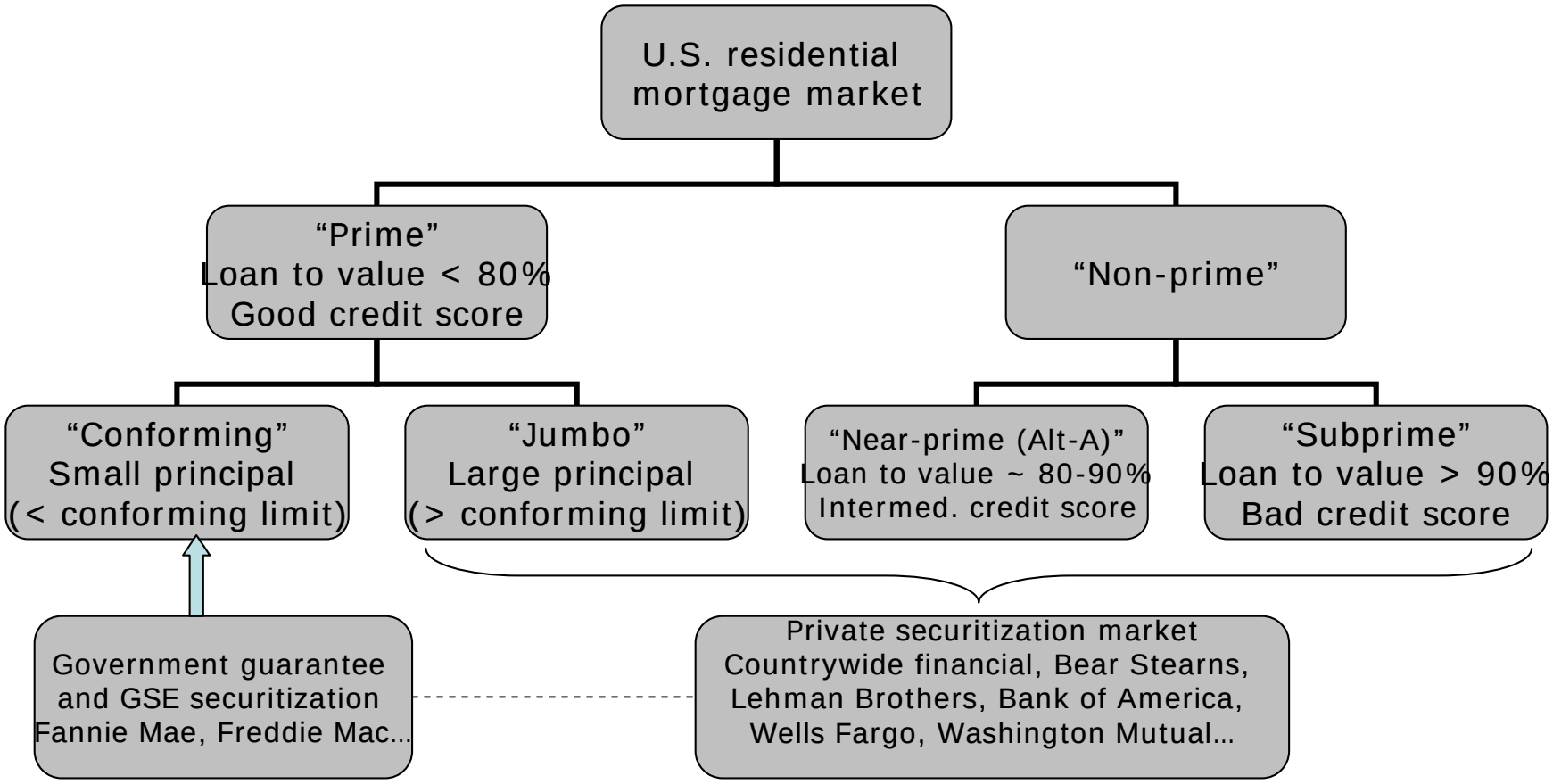
Complexity of the Financial Crises



THE US MORTGAGE MARKET



Residential Mortgage Market



Long Chain from Borrower to Investor

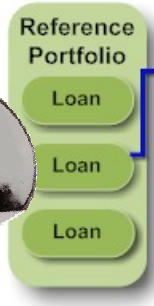
Borrower

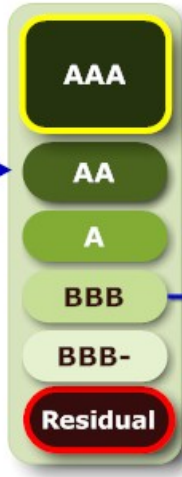
Originator

Arranger/issuer

Warehouse Lender

Rating Agencies

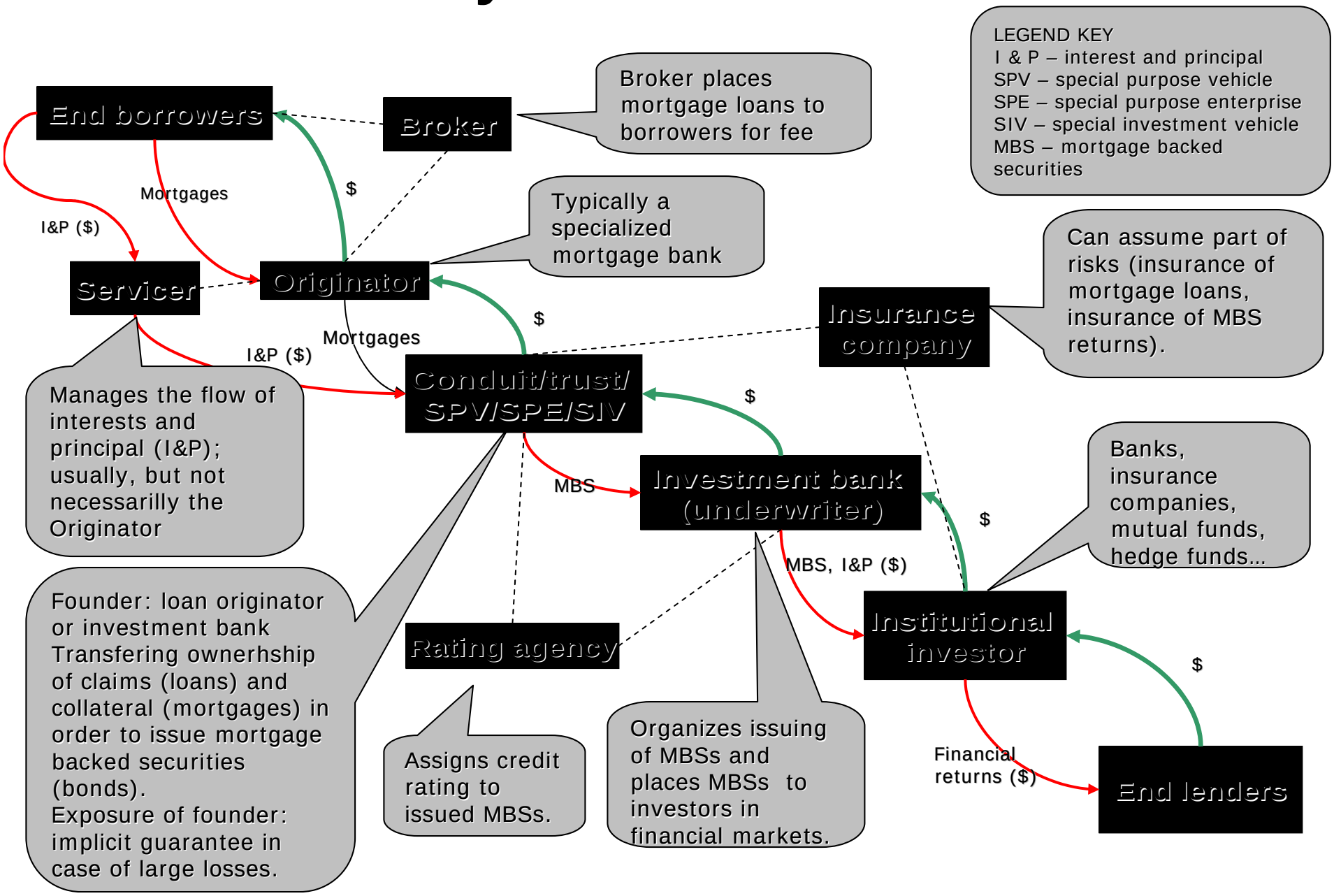




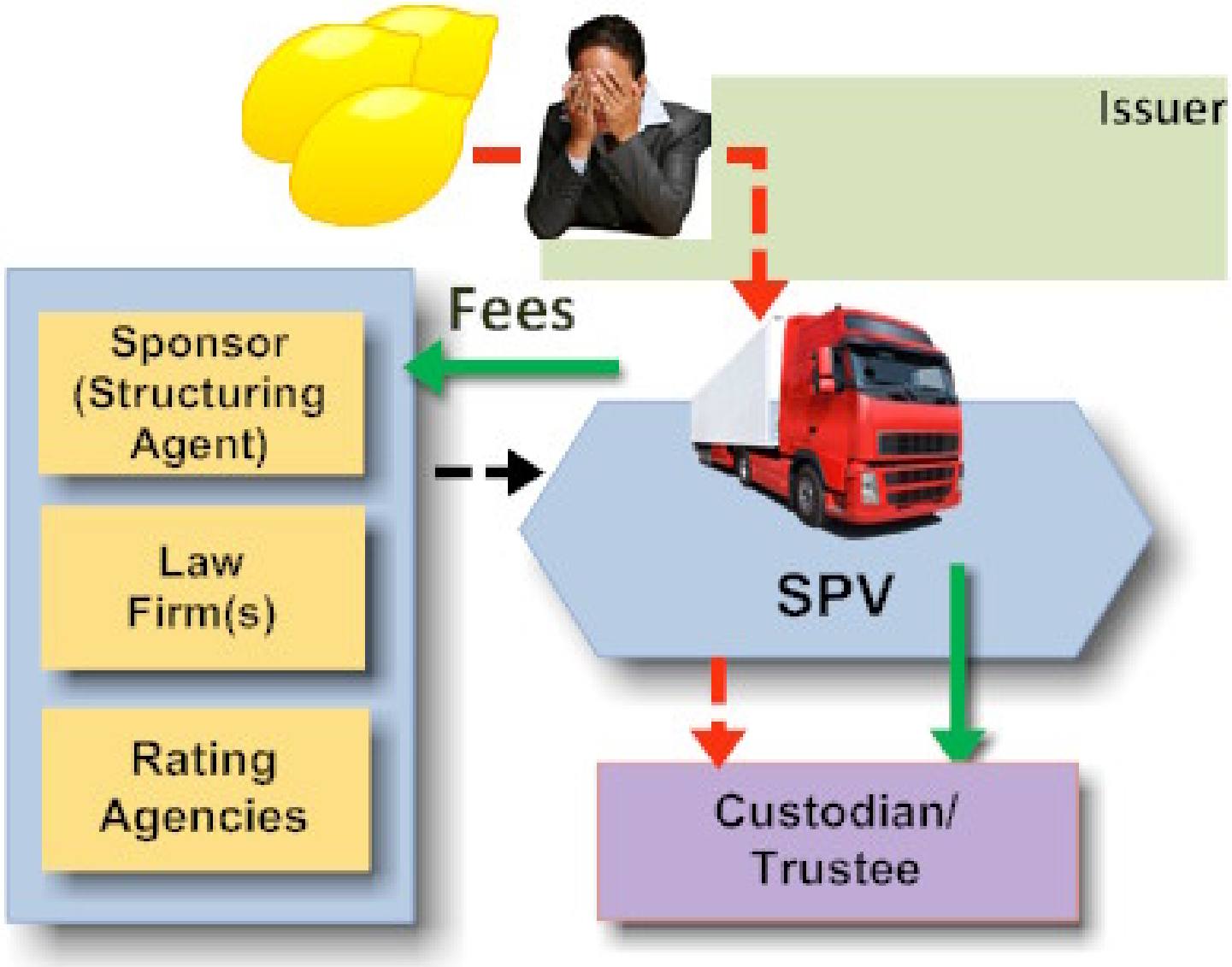
Asset Manager

Investor

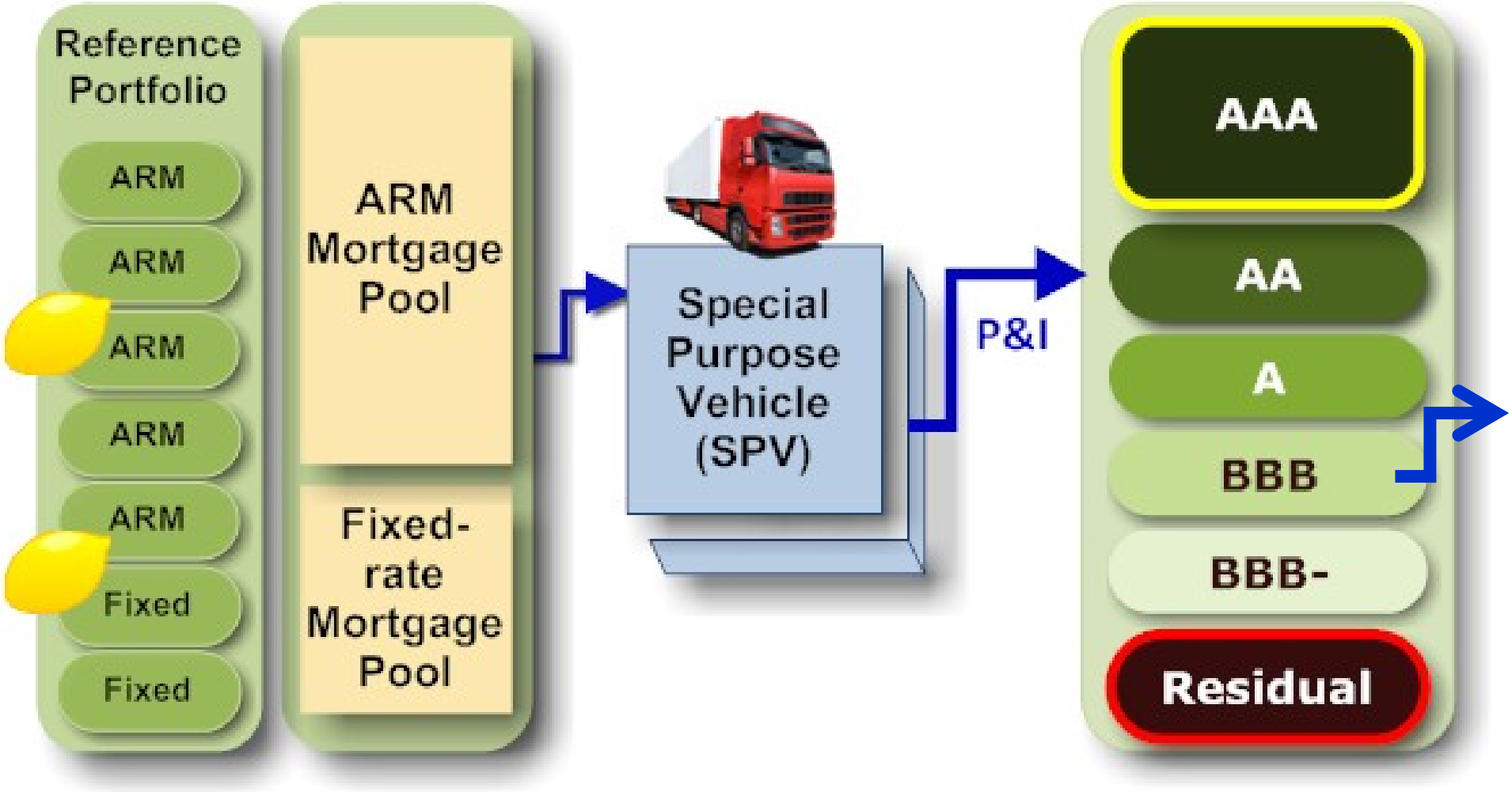
The Players in Securitization



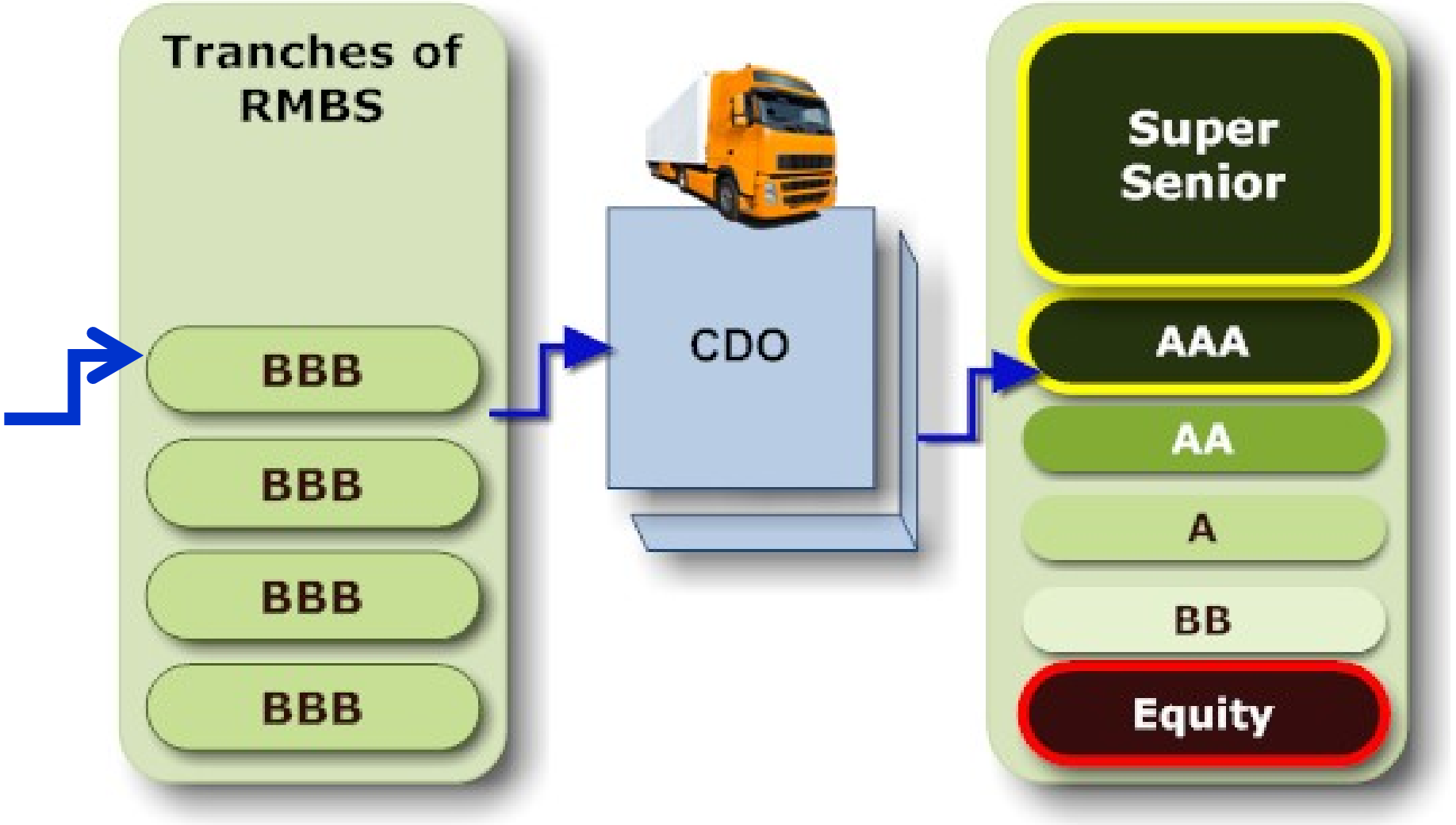
SPV makes securitization possible (off balance sheet if “true sale”)



SPV Pools Loans (Left). SPV Issues Mortgage-Backed Securities (MBS, Right)



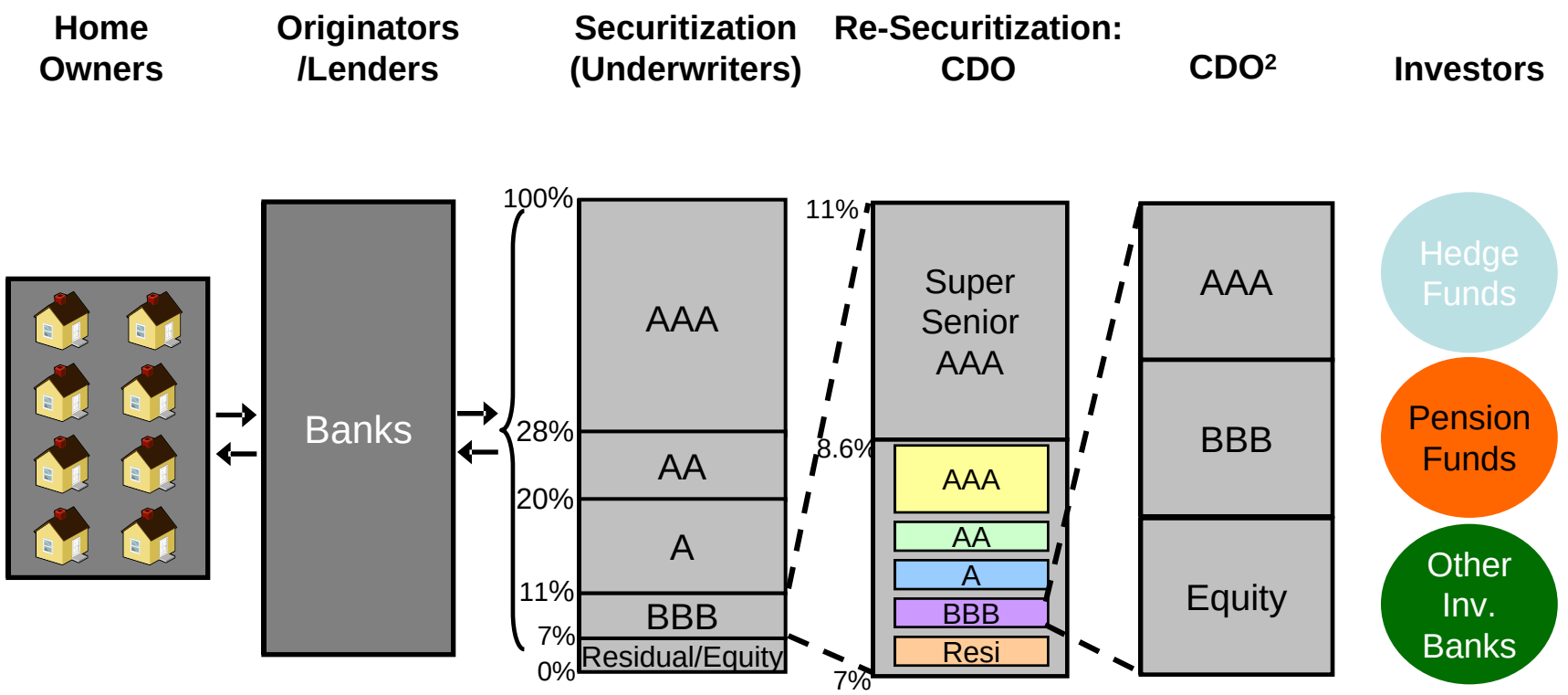
CDO is Another SPV that Pools Tranches of MBS. CDO Issues Tranches to Investors.



The Key to AAA Ratings in Securitization

- Credit enhancement facilities
  - External:
    - Bond insurance – monoline insurers;
    - Letter of credit – banks.
  - Internal:
    - Overcollateralization: assets (underlying loans)>liabilities (issued securities);
    - Excess spread: lending rate (underlying loans) >borrowing rate (issued securities);
    - Reserve account: established to absorb losses;
    - Senior/subordinated debt structure: pecking order in absorption of loan losses to derivative securities (equity tranche first, senior tranches last).
- Liquidity facilities – sponsor banks provide liquidity in case of cash shortages due to redemptions

Real-Estate-Related Securities



1) Lender makes mortgage loan to home owners

2) Lender issues secured certificates backed by loans

3) Bonds backed by mortgages created in the primary market

4) Investments may become re-securitized (bonds based on bonds)

5) New CDOs can be created from "select" tranches of existing CDOs with a further "re-rating" of risk

6) Investors buy customized financial instruments

Complexity of Structure Finance

"...bank boards and bank executives have failed to understand complex mortgage-backed banking products, as have central bankers, regulators and credit rating agencies."

... ***Financial Times***, 20 Sept 2008

Even Alan Greenspan, the nation's top economist, was befuddled by the CDO

- “Look, I've got some fairly heavy background in mathematics. But some of the complexities of some of the instruments that are GOING INTO CDOs BEWILDERS ME. I don't understand what they're doing. And if I -- I figured if i didn't understand it, and I had access to a couple hundred Ph.D.s, HOW THE REST OF THE World is going to understand it sort of bewilders me.”
- *If Alan Greenspan can't understand exactly how they're getting to where they're getting on these particular structured products, then how are any of these investors supposed to understand it? Well, we learned the answer to that. They didn't.*

... House of Card; CNBC Documentary

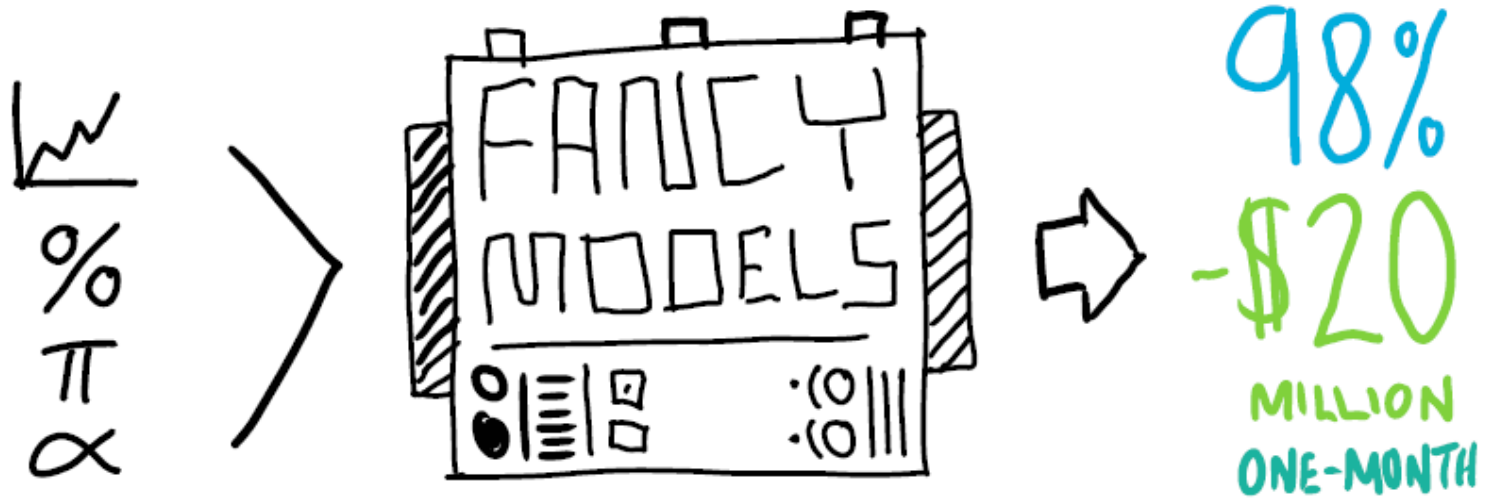
Risk Management

Financial firms didn't manage risk *correctly*

- Difficulties in Quantifying Risk
- VAR models
- Rating models

Example: Value at Risk (VAR)

- The VaR analysis tries to give the firm a look at how much risk it's taking.
- It starts with the analysis of historical data & statistics
- The data is then run through a bunch of advanced models
-



This means that 98% of the time, your investments won't lose over $20 million in a one-month period

Why VaR Causes Problems:

There are 3 reasons

- Not very good at assessing extremely rare risks
- Historical data doesn't necessarily predict future returns
- VaR ignores systemic risk

A Copula Codifies Dizzying Complexity with a Single "Elegant" Formula

Dizzying Complexity

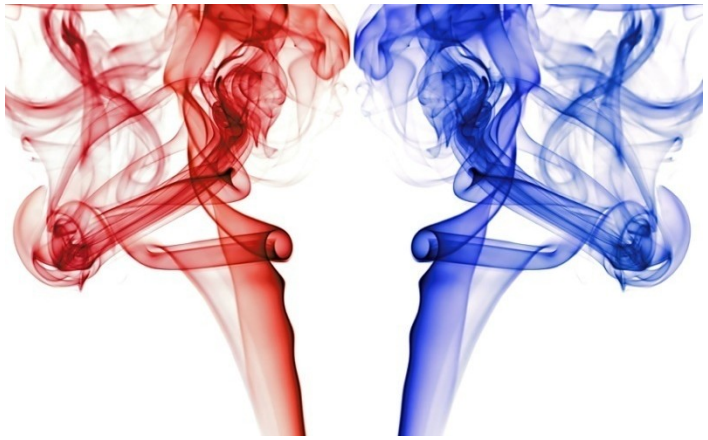
- Macro economy
- n(n+1)/2 pairwise correlations (a lot!)
- Local real estate
- Financial Markets
- Human nature
- Geopolitical etcetera

Elegant formula *

$$Q(T \mid M) = N\left(\frac{N^{-1}[Q(T)] - \sqrt{\rho}M}{\sqrt{1-\rho}}\right)$$

* Plug-in critical assumptions where either "we don't know" or we blindly assume "history will continue"

Totally incorrect rating



"The ratings methodologies for some of these [securitized] products are so sloppy that I reject the ratings of all three 'nationally recognized' rating agencies…tranches of securitizations rated using flawed methodologies themselves used as collateral in other securitizations **causing the errors to compound and spiral out of control. Ratings on these products are based on smoke and mirrors**." **Janet Tavakoli, memo to S.E.C. (Feb 13, 2007)**

Failure in the Three Major Areas of Risk Management

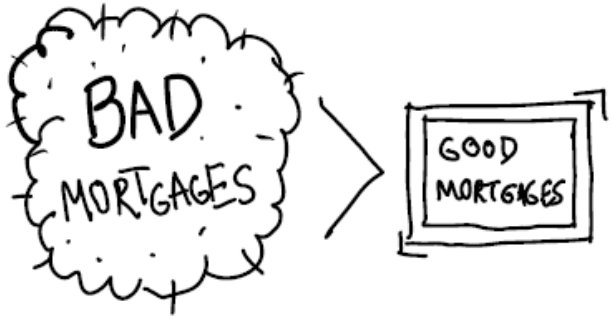
- Credit Risk Management
- Market Risk Management
- Operational Risk Management

Misaligned incentives

- Home buyers
- Brokers
- Repackages of mortgages
- Wall-street bankers
- Rating Agencies
- Procyclical behavior of leverage

Misaligned Incentives Were Pervasive

EXECUTIVES



MORTGAGE BROKERS

RATING AGENCIES

HOME BUYERS

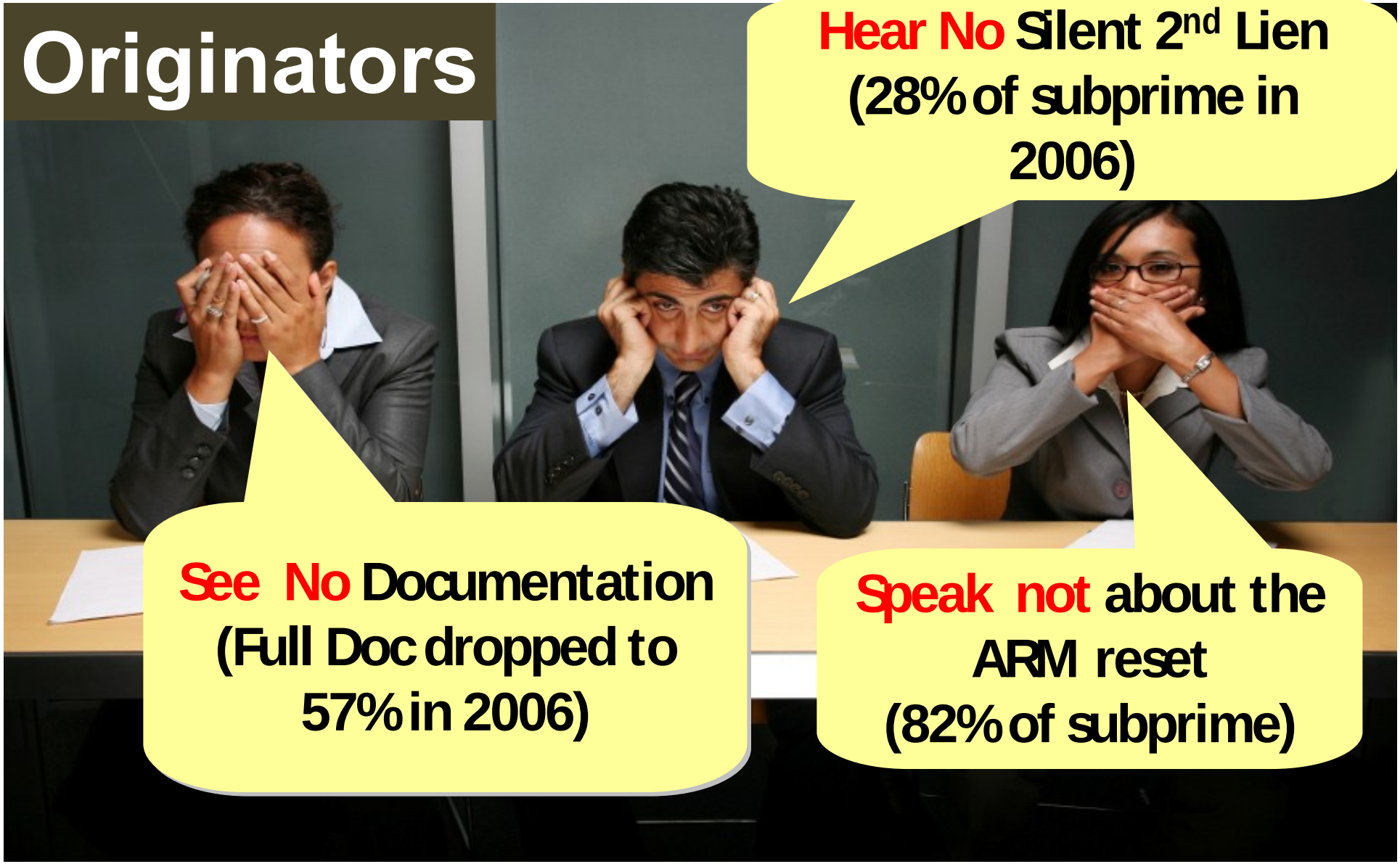
There was no link between immediate action and subsequent consequence

Pro-cyclical Behavior of Leverage

"After a string of good news, risk seems tamed, but, when a new tail event occurs, the estimated risk measure may sharply increase. This problem is most pronounced if the data samples are short. Hence, regulatory requirements that are naively based on estimated risk measures would be stringent during a crisis and lax during a boom. This introduces procyclicality – exactly the opposite of the goal of effective regulation."

... Adrian & Brunnermeier

It s Hard to Price Risk Without Data



Links in the process

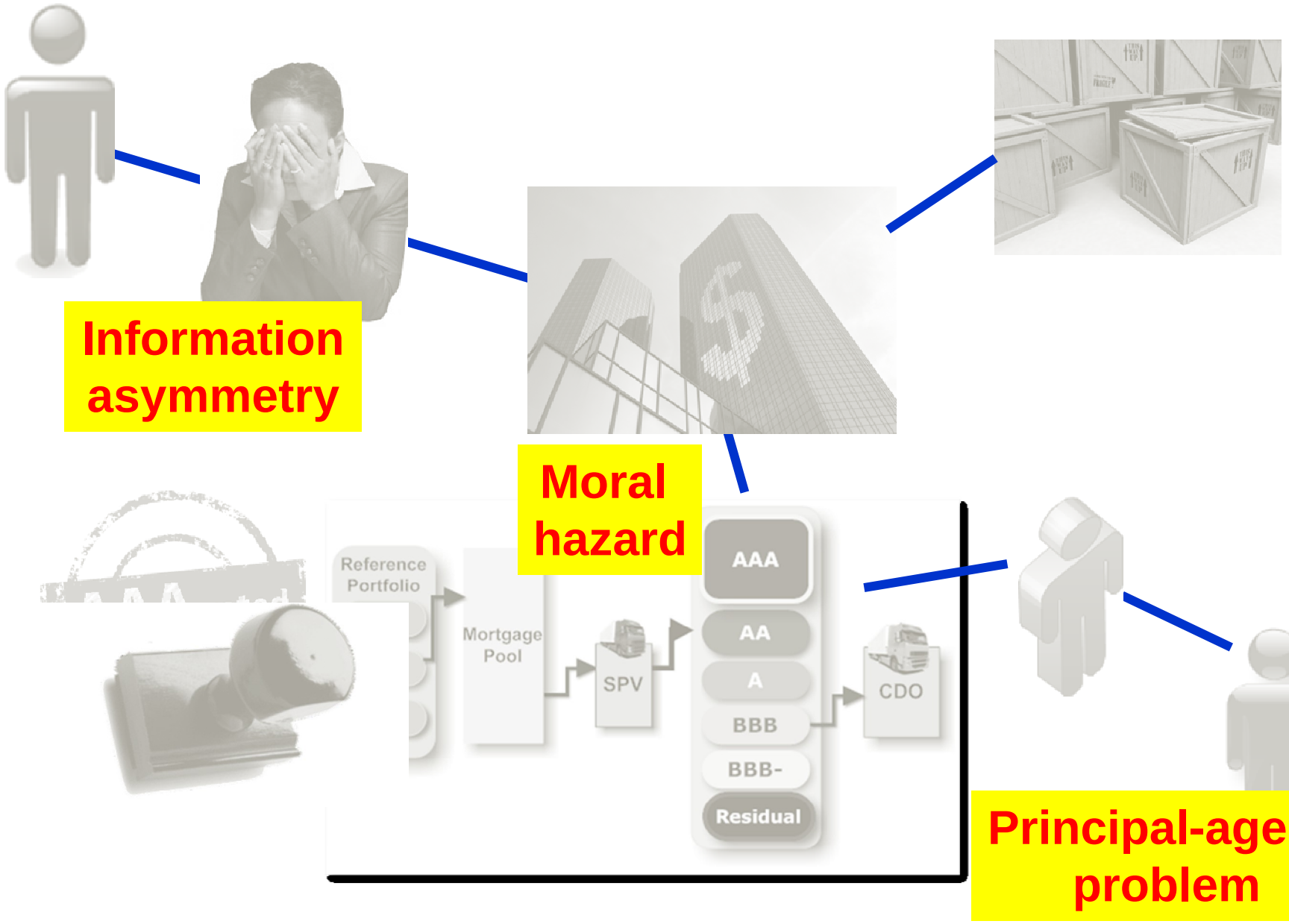
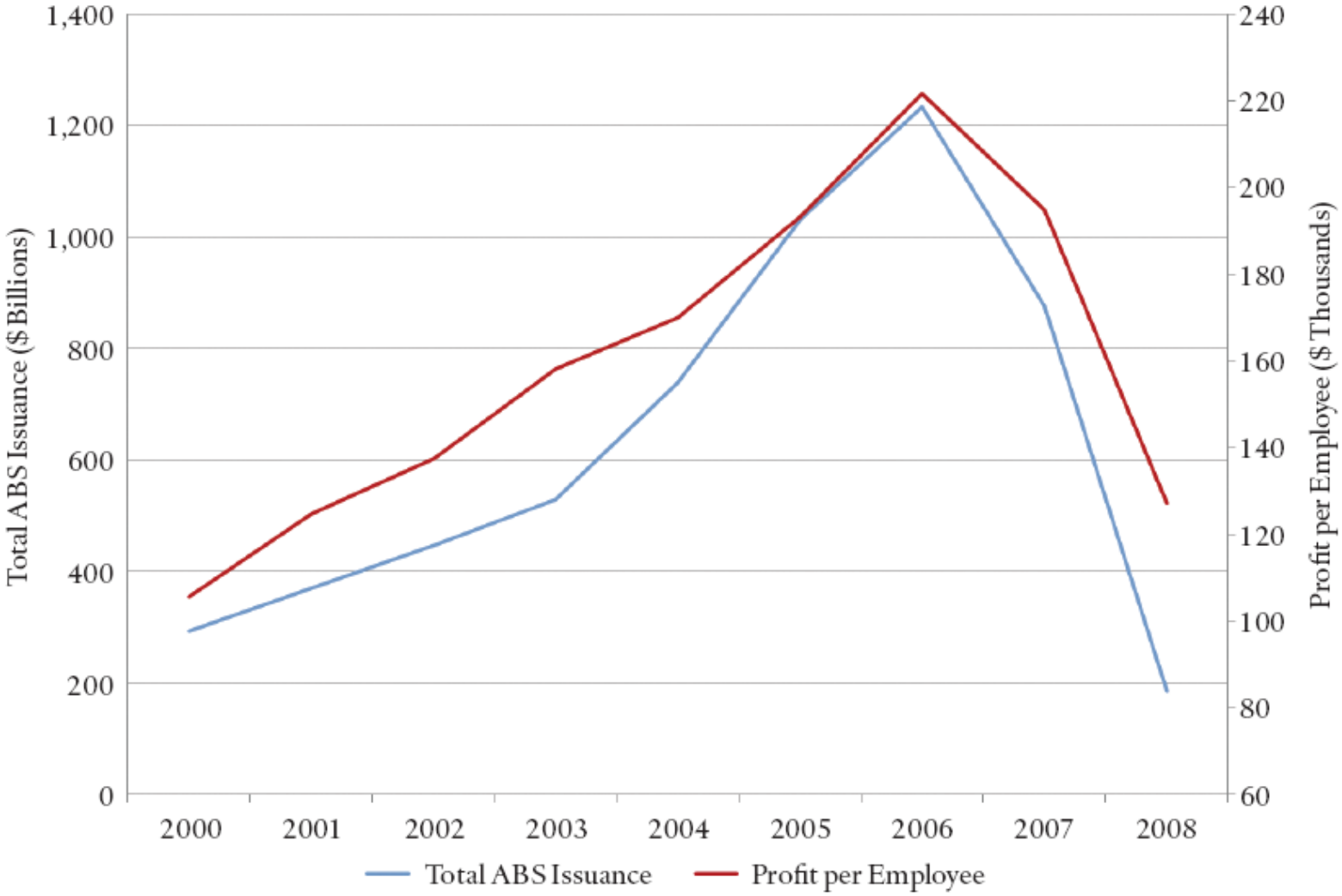


FIGURE 5. MOODY'S PROFIT PER EMPLOYEE VS. TOTAL ABS ISSUANCE



Data Source: Bloomberg.

Performance Incentives

- "...a reward system that has granted huge bonuses to those who peddled toxic mortgage-related products...."
- "Almost as absurd has been the degree of leverage racked up by investment banks."

*... **Financial Times***, 20 Sept 2008

Ratings Inflation

- “At that time, when home prices surged and virtually no borrowers defaulted triple B-rated securities from mortgages looked as good as the safe triple As.”
- “The class B is suddenly much safer than it used to be,” she said. “And over time it becomes like a triple A security. Eventually, the market gets smart and says, ‘let's lower the requirements for triple A.’”

...Ann Rutledge
Moody's Investors Service

Transmission to Institutional Investors

A crisis in a relatively narrow segment of the U.S. financial system spread through the U.S. and international financial system. How?

- Investor miopia – excessive focus on yield and insufficient focus on risk due to benign international financial environment.
- Difficulties in estimating risks – failure of risk assessment models for structured finance instruments, which are not actively traded in the secondary markets (such as CDO and CDO2).

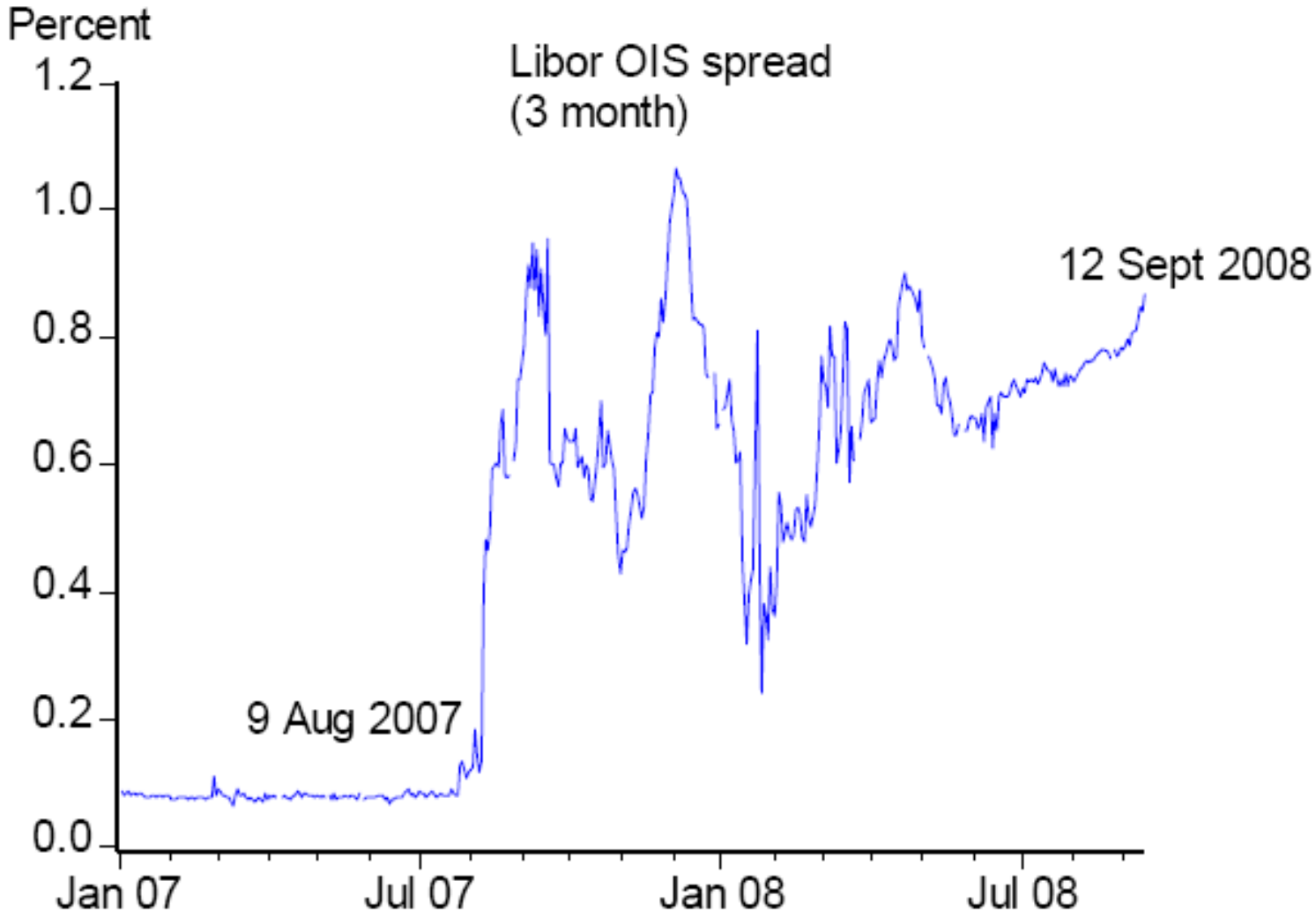
Transmission to Institutional Investors

- Over reliance on credit rating agencies – systematic large downgrades of MBS credit ratings since July 2007 cause panic among investors and subsequent "flight to quality" ⇒ repricing of risk!
- Contagion effect – a lack of confidence spread from the narrow MBS segment to the wider ABS segment, which is based on a much broader pool of claims, including corporate bonds, student loans, car leases, credit card payments etc.
- Deleveraging (unwinding of credit) – investors' lack of condifence ⇒ fire sales of structured finance instruments ⇒ forced liquidation of SIV/SPV/SPE assets ⇒ falling prices of illiquid structured finance instruments ⇒ further lack of confidence ⇒ accelerated fire sales of structured finance instruments...

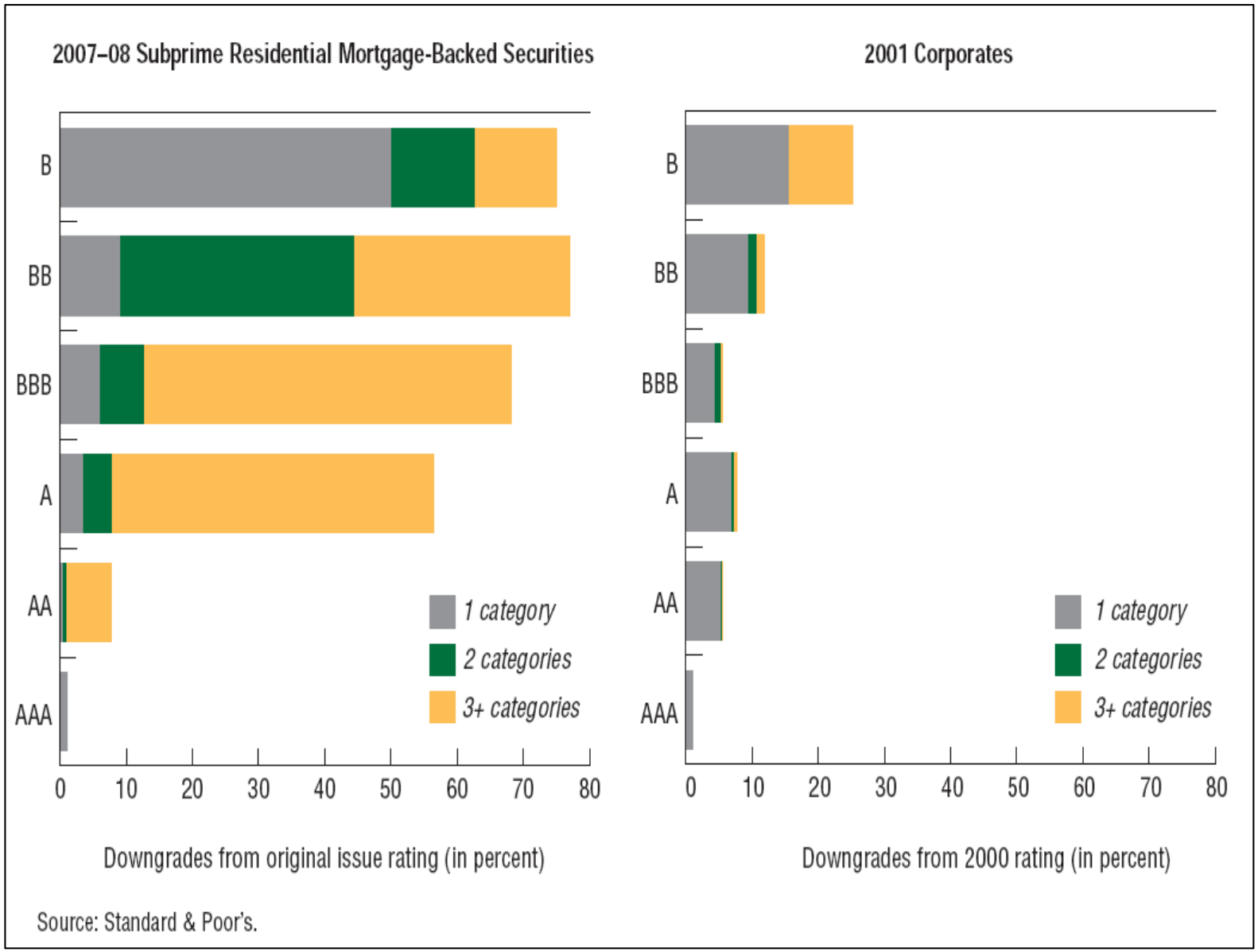
Transmission and Spread

- Collapse of the government backed mortgage system in the USA (Fannie and Freddie) followed by meltdown of major investment banks (Lehman, Bear, Merrill) exposed to mortgage market
- Mark-to-market asset pricing effects on balance sheets and cumulative liquidity retraction due to rising risk aversion;
- Dow fall of CDS insurer, AIG)

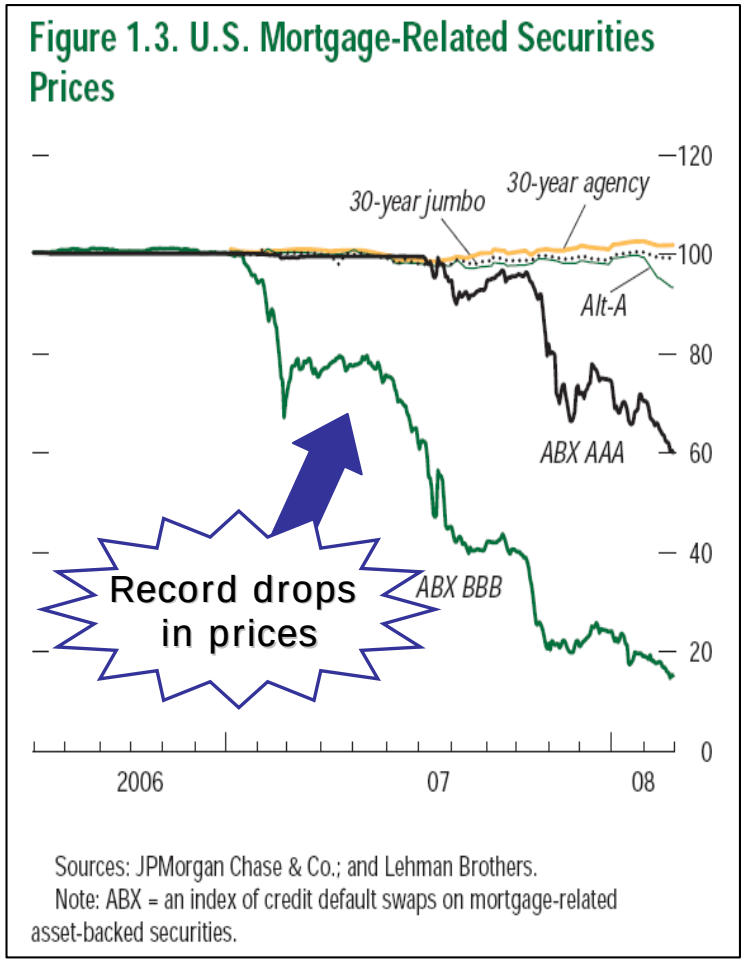
“A Black Swan in the Money Market” - Taylor and Williams

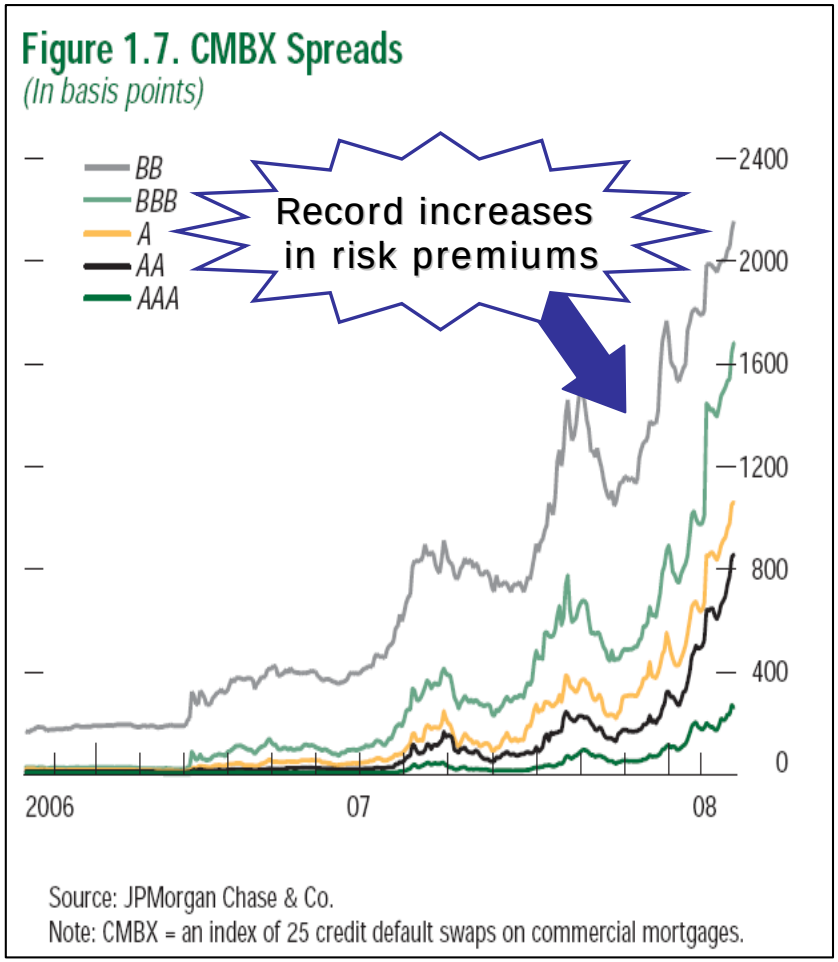


Rating Downgrades Increased Uncertainty

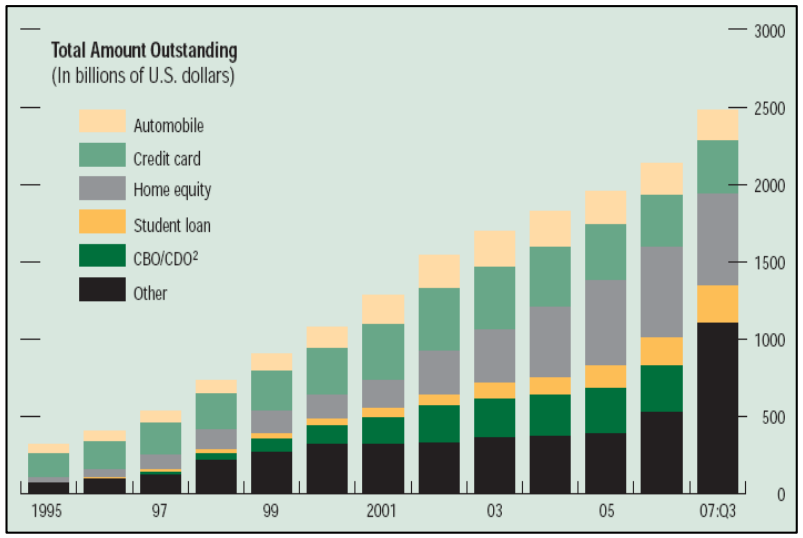


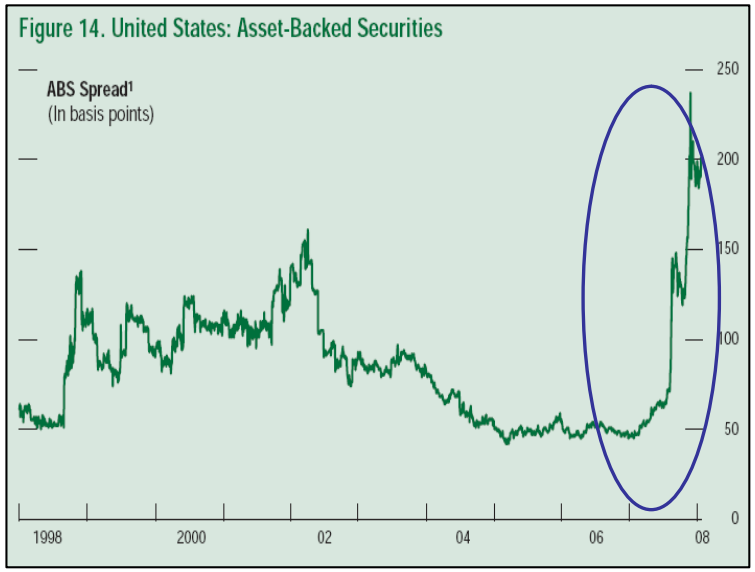
Risk Aversion Spreads from Residential to Commercial Mortgages



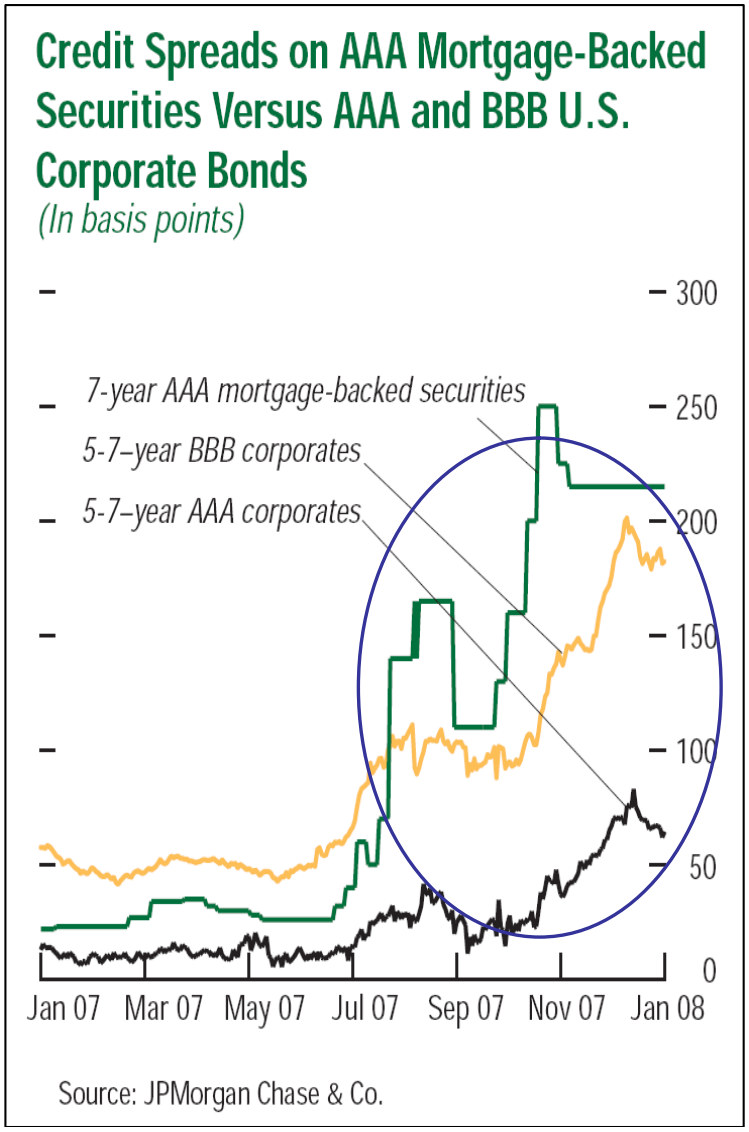


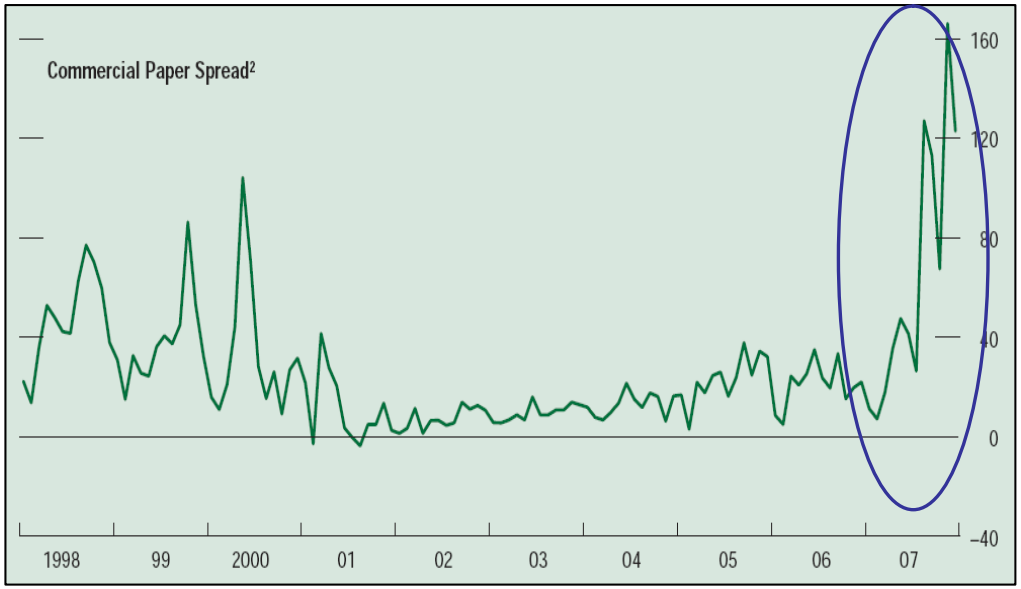
Risk Aversion Spreads from Mortgage to other Asset Derivatives





Risk aversion Speeds from Derivatives to Corporate Debt Market





Transmission to Banks

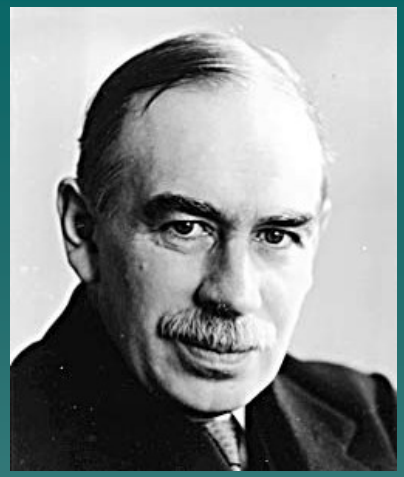
The crisis spreads from institutional investors to the interbank market

- Realization of contingent liabilities of banks to various investment vehicles
  - Important initial role of short-term ABCP (asset backed commercial papers) exposed to U.S. subprime market in transmission of the crisis. They are particularly vulnerable to refinancing risk.
  - Conduits issuing ABCPs were established & sponsored by several european banks. As they came under pressure due to investors' redemptions some banks withdrew their support $\Rightarrow$ signal that banks may have difficulties in meeting their obligations!

Transmission to Banks

- Non-functioning of the securitization market – banks can no longer transfer risks off their balance sheets (problems with pending LBOs). Unwanted claims put pressure on banks' capital adequacy.
- Hoarding of liquidity by banks – due to high uncertainty, banks create a dangerous liquidity crunch in the interbank market
  - Banks build-up their own precautionary cash reserves against realization of unforseen contingent liabilities.
  - Banks stop lending to each other because of adverse selection (lack of confidence)
- Hoarding of liquidity by non-financial companies – Due to observed liquidity shortages in the market, companies try to secure cash (for example, by drawing on their credit lines), creating further liquidity pressures for banks.

Recalling Keynes



In his *General Theory*, Keynes notes:

"Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation. When the capital development of a country becomes a byproduct of the activities of a casino, the job is likely to be ill-done."

Alan Greenspan conceded the meltdown had revealed a flaw in a lifetime of economic thinking and left him in a "state of shocked disbelief."

- Greenspan acknowledged that he had made a "mistake" in believing that banks, operating in their own self-interest, would do what was necessary to protect their shareholders and institutions. He called that "a flaw in the model ... that defines how the world works."
- *The collapse "shocked me," he said. "I still do not fully understand why it happened and obviously to the extent that I figure where it happened and why I will change my views. If the facts change I will change."*

Q & A

Thank you

Market Risk Mismanagement

- “Really, interest rates are not going to rise soon”
- “The CDO market is too small to have a severe impact”
- “Black swan” or extreme value event not properly considered

Operational Risk Mismanagement

- Loan originator had bad incentives
- Wall street had bad incentives
- Rating agencies had bad incentives
- Investors trusted all three of the above a little too much

But risk silos really don’t make sense

- Bad incentives to the loan originator (ORM) led to PD being lowered at origination (CRM)
- Incorrectly low PDs (CRM) reinforced by “interest rates are not going to rise soon.” (MRM)
- Wall street, rating agencies, and investors only too readily accepted (ORM) that “interest rates are not going to rise soon” (MRM)

Names for stuff we already know

Information Asymmetry

- When you know something the other guy doesn't. Something he would want to know. And you don't tell him.

Moral Hazard

- You take risks you otherwise wouldn't. Because it's not your money.

Principal-Agent

- You act in only in your own interest. Deciding to ignore that you are a "professional" with a "client"

Lending Tricks or Loan Requirements

- “SISA” (stated income, stated assets)
- “NISA” (no income, stated assets),
- “NINA” (no income, no assets),
- “NEVA” (no income, no job, verify assets),
- “NINJA” (no income, no job, no assets).