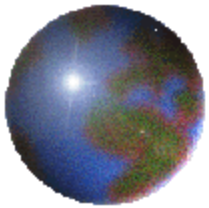


The Financial Crisis 2008-2009 and Regulation

The Financial Crisis of 2008-2009

- The worst financial crisis in the US since the Great Depression (1933)
- Securitization and derivatives linked to mortgage markets played an important role
- The aftershocks of the crisis shaped the markets in fundamental ways. We speak now about pre-2008 and post-2008 markets.
- Regulatory overhaul

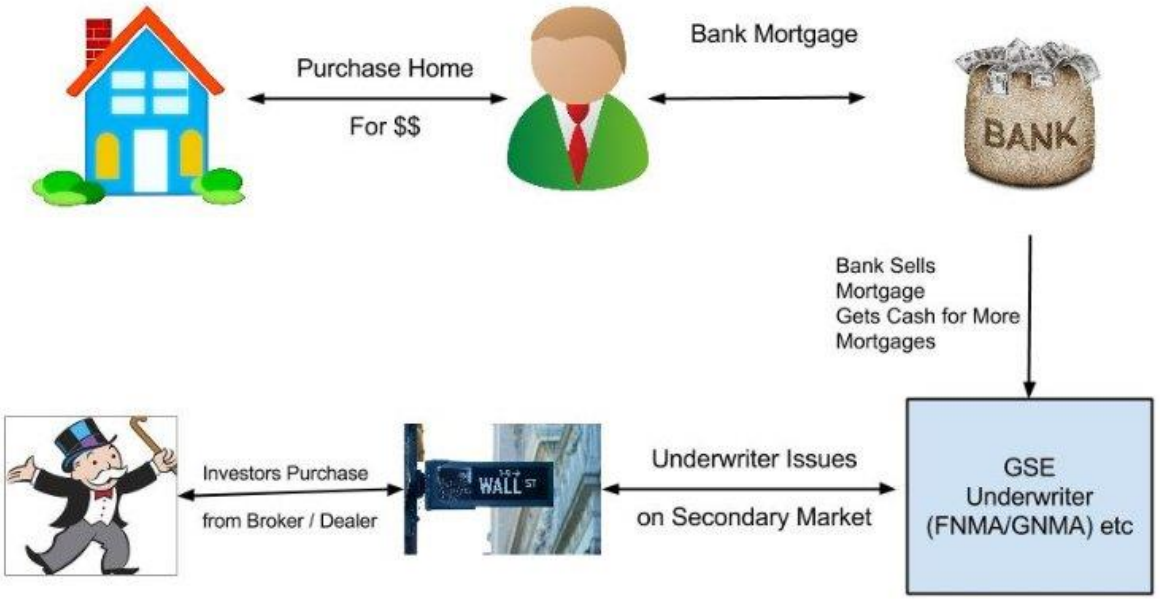
Securitization

- Traditionally banks have funded loans with deposits
- Securitization is a way that loans can increase much faster than deposits

Asset Backed Securities

- Securities created from a portfolio of loans, bonds, credit card receivables, mortgages, auto loans, aircraft leases, music royalties, etc
- Usually the income from the assets is tranched
- A “waterfall” defines how income is first used to pay the promised return to the senior tranche, then to the next most senior tranche, and so on.

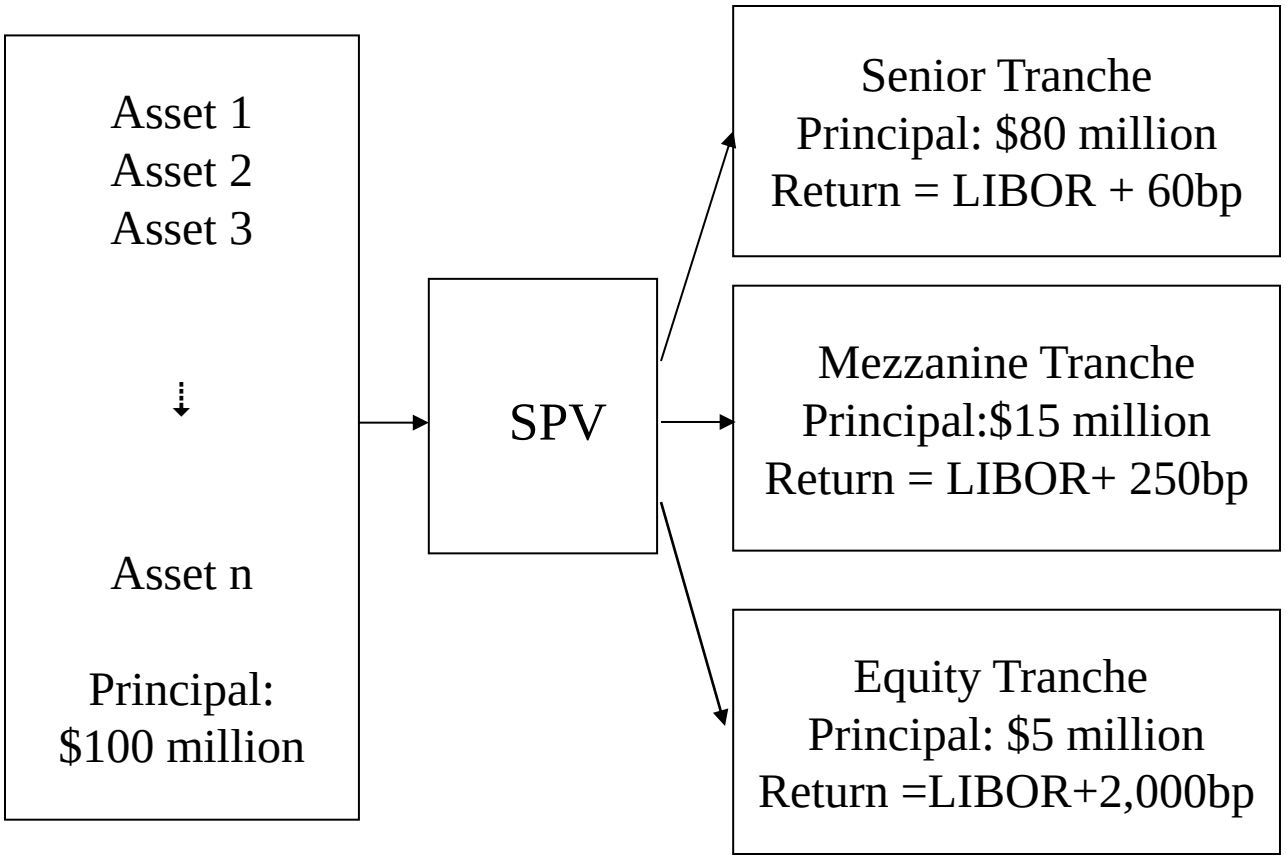
The mortgage market in the US



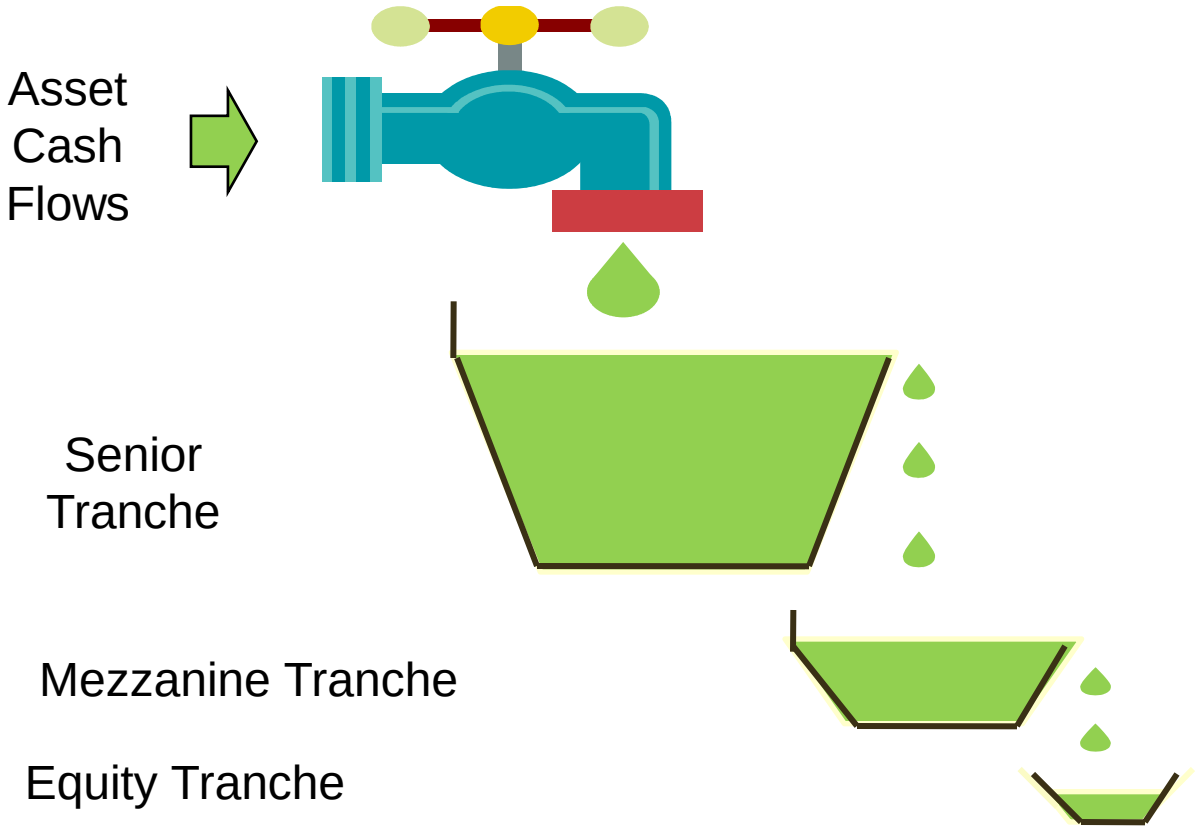
Collateralized Debt Obligations (Page 581-583)

- A cash CDO is an ABS where the underlying assets are debt obligations (bonds/loans)
- A synthetic CDO involves forming a similar structure with short CDS contracts
- In a synthetic CDO most junior tranche bears losses first. After it has been wiped out, the second most junior tranche bears losses, and so on

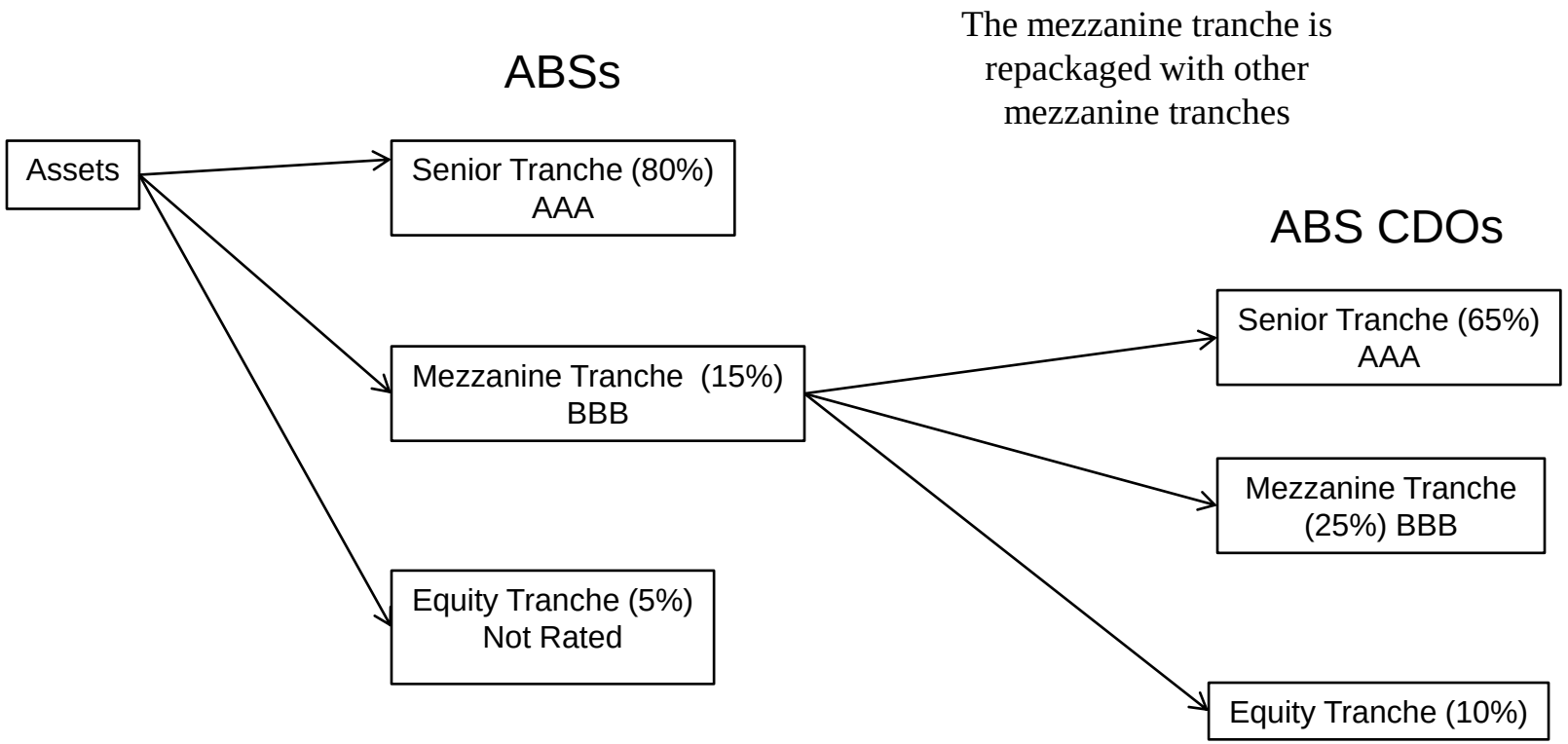
Asset Backed Security (Simplified)



The Waterfall

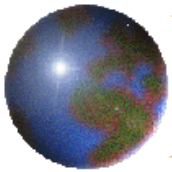


ABS CDOs or Mezz CDOs (Simplified)



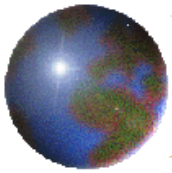
Synthetic CDO Example

- Synthetic CDOs generate cash flow by selling Credit Default Swaps
- The resulting cash flows are passed on to investors, tranched into several tranches
  - Equity tranche is responsible for losses on underlying CDSs until they reach 5% of total notional principal (earns 1000 bp spread)
  - Mezzanine tranche is responsible for losses between 5% and 20% (earns 200 bp spread)
  - Senior tranche is responsible for losses over 20% (earns 10 bp spread)



Credit Derivatives modeling

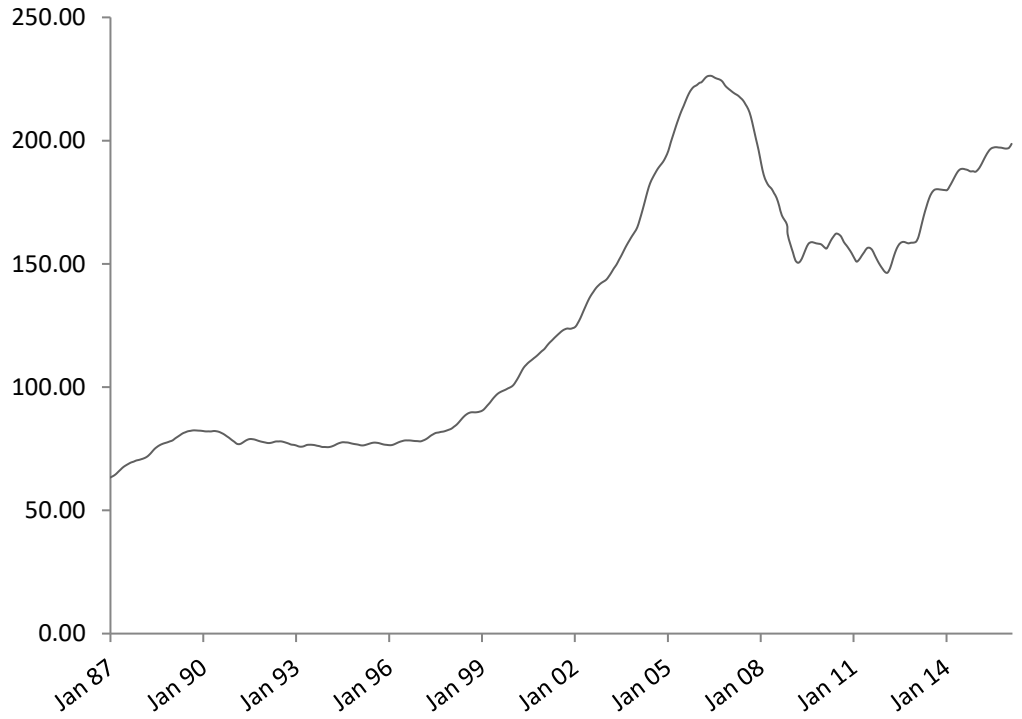
- CDO tranche pricing requires that we compute the probability distribution of the default losses for a portfolio of bonds/loans
- CDO tranches are similar to options on the loss distribution
- The shape of the loss distribution of a portfolio is very sensitive to the default correlation between the portfolio assets: default contagion
- Modeling the correlation is highly non-trivial. The Gaussian copula was very popular but also misleading



Mortgage modeling

- ABS CDO add a new level of complexity to the problem: mortgage dynamics
- ABS backed by residential mortgages are sensitive to the prepayment and defaults in the mortgage markets
- These events depend on macroeconomic factors (employment, inflation, interest rates) and modeling them reliably is very difficult

U.S. Real Estate Prices, 1987 to 2016:
S&P/Case-Shiller Composite-10 Index



What happened…

- Starting in 2000, mortgage originators in the US relaxed their lending standards and created large numbers of subprime first mortgages.
- This, combined with very low interest rates, increased the demand for real estate and prices rose.
- To continue to attract first time buyers and keep prices increasing they relaxed lending standards further
- Features of the market: 100% mortgages, ARMs, teaser rates, NINJAs, liar loans, non-recourse borrowing
- Mortgages were packaged in financial products and sold to investors

What happened...

- Banks found it profitable to invest in the AAA rated tranches because the promised return was significantly higher than the cost of funds and capital requirements were low
- In 2007 the bubble burst. Some borrowers could not afford their payments when the teaser rates ended. Others had negative equity and recognized that it was optimal for them to exercise their put options.
- Foreclosures increased supply and caused U.S. real estate prices to fall. Products, created from the mortgages, that were previously thought to be safe began to be viewed as risky
- There was a “flight to quality” and credit spreads increased to very high levels
- Many banks incurred huge losses

What Many Market Participants Did Not Realize…

- Default correlation goes up in stressed market conditions
- Recovery rates are less in stressed market conditions
- A tranche with a certain rating cannot be equated with a bond with the same rating. For example, the BBB tranches used to create ABS CDOs were typically about 1% wide and had “all or nothing” loss distributions (quite different from BBB bond)
- This is quite different from the loss distribution for a BBB bond

Regulatory Arbitrage

- The regulatory capital banks were required to keep for the tranches created from mortgages was less than that for the mortgages themselves

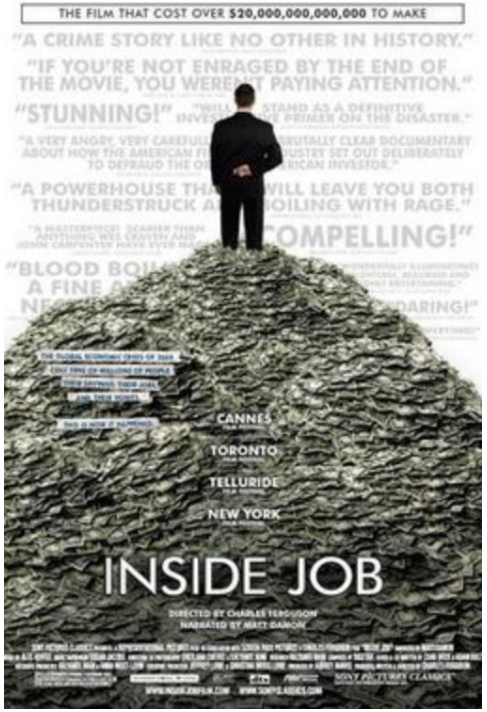
Incentives

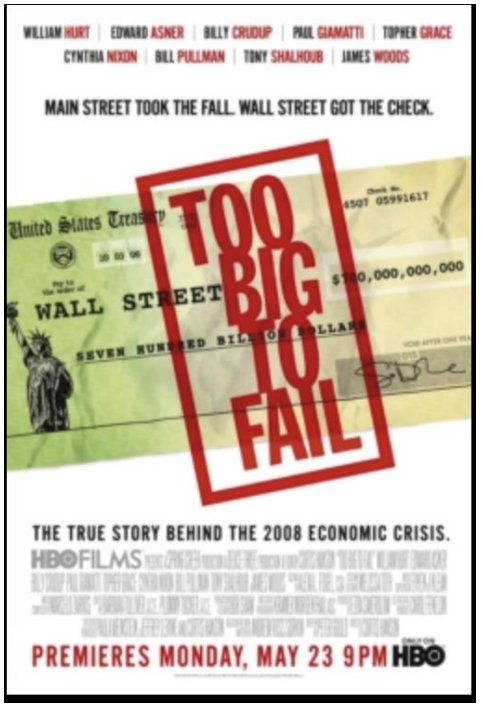
- The crisis highlighted what are referred to as agency costs
  - Mortgage originators (Their prime interest was in in originating mortgages that could be securitized)
  - Valuers (They were under pressure to provide high valuations so that the loan-to-value ratios looked good)
  - Traders (They were focused on the next end-of year bonus and not worried about any longer term problems in the market)

The Aftermath…

- A huge amount of new regulation (Basel II.5, Basel III, Dodd-Frank, etc). For example:
  - Banks required to hold more equity capital with the definition of equity capital being tightened
  - Banks required to satisfy liquidity ratios
  - CCPs for OTC derivatives
  - Bonuses spread over several years
  - Proprietary trading restricted (Volcker rule)

The Financial Crisis in Movies





The London Whale (2012)

- The CIO group at JP Morgan was in charge of hedging the macro risks of the bank
- The bank is short credit risk, so they took long positions in CDX.IG.S9, a credit index swap, and its tranches.
- This strategy was profitable in 2007-2009 due to the EU crisis, but produced massive losses in 2012 because of the improving global credit situation.
- However the position became so large that it became difficult to unwind quickly. The trading position became untenable.