



The Subprime Crisis 1: Financial Innovations

Mishkin Ch. 9

Coval, Jurek, and Stafford (2009)

The Subprime Financial Crisis of 2007 - 2008

- We can say that mismanagement of financial innovation in the subprime mortgage market and a bursting of a bubble in housing price were the underlying forces behind the financial crisis of 2007 - 2008

Financial Innovations in the Mortgage Markets

- **Subprime mortgages** are mortgages for borrowers with less-than-stellar credit records
- **Alt-A mortgages** are mortgages or borrowers with higher expected default rates than prime, but with better credit records than subprime borrowers
- High-risk mortgages are bundled and risk-quantified in a standardized debt security called **mortgage-backed securities**
- **Structured credit products** (e.g. CDOs, CDO²s, CDO³s) are derived from cash flows of underlying assets and can be tailored to have a particular risk characteristics
- **Structured investment vehicles** pay off cash flows from pool of assets such as mortgages (like CDOs), but they issued asset-backed commercial papers (which is short-term)

Structured Credit Products

- The essence of structured finance activities is the *pooling* of economic assets like loans, bonds, and mortgages, and the subsequent issuance of a prioritized capital structure of claims, known as *tranches*, against these collateral pools
- As a result of the prioritization scheme used in structuring claims, many of the manufactured tranches are far safer than the average asset in the underlying pool
- This ability of structured finance to repackage risks and to create “safe” assets from otherwise risky collateral led to a dramatic expansion in the issuance of structured securities, most of which were viewed by investors to be virtually risk-free and certified as such by the rating agencies

Manufacturing AAA-rated Securities

- Manufacturing securities of a given credit rating requires tailoring the cashflow risk of these securities—as measured by ***the likelihood of default*** and ***the magnitude of loss incurred*** in the event of a default—to satisfy the guidelines set forth by the credit rating agencies
- Structured finance allows originators to accomplish this goal by means of a two-step procedure involving ***pooling*** and ***tranching***

Pooling

- In the first step, a large collection of credit-sensitive assets is assembled in a portfolio, which is typically referred to as a “special purpose vehicle”
- The special purpose vehicle is separate from the originator’s balance sheet to isolate the credit risk of its liabilities—the tranches—from the balance sheet of the originator
- At this stage, since the expected portfolio loss is equal to the mean expected loss on the underlying securities, the portfolio’s credit rating would be given by the average rating of the securities in the underlying pool

Tranching

- To manufacture a range of securities with different cash flow risks, structured finance issues a capital structure of prioritized claims, known as ***tranches***, against the underlying collateral pool
- The tranches are prioritized in how they absorb losses from the underlying portfolio. For example, senior tranches only absorb losses after the junior claims have been exhausted, which allows senior tranches to obtain credit ratings in excess of the average rating on the average for the collateral pool as a whole

A Two-asset Example

- Consider two identical securities— call them “bonds”—both of which have a probability of default p_D , and pay \$0 conditional on default and \$1 otherwise
- Suppose we *pool* these securities in a portfolio, such that the total notional value of the underlying fund is \$2, and then issue two tranches against this fund, each of which pay \$1
- A “junior” tranche can be written such that it bears the first \$1 of losses to the portfolio; thus, the junior tranche pays \$1 if both bonds avoid default and zero if either bond defaults
- The second, “senior” tranche, which bears losses if the capital of the junior tranche is exhausted, pays \$1 if neither bond defaults or if only one out of two bonds defaults; it only defaults if both bonds default

A Two-asset Example

- It should be intuitively clear that to compute the expected cash flows (or default probabilities) for the tranches, we will need to know the likelihood of observing both bonds defaulting simultaneously
- If the defaults of the two bonds are imperfectly correlated, the senior tranche will pay either \$1 or \$0—just like the individual bonds—except that it will be less likely to default than either of the underlying bonds

A Two-asset Example

- For example, if the two bonds have a 10 percent default probability and defaults are (perfectly) uncorrelated, the senior tranche will only have a 1 percent chance of default
- **Recall** that for two independent events A and B with probabilities $P(A)$ and $P(B)$. The probability that A and B occur together is $P(A \text{ and } B) = P(A) \times P(B)$
- This principle can be extended to any number of independent events. For example, the probability of A, B, and a third independent event C is $P(A \text{ and } B \text{ and } C) = P(A) \times P(B) \times P(C)$

A Two-asset Example

- This basic procedure allows highly risky securities to be repackaged, with some of the resulting tranches sold to investors seeking only safe investments
- Obviously, junior tranches, being risky, will have low prices and high promised returns, while the senior tranches, being relatively safe, will have relatively higher prices and lower promised returns

A Central Insight

- By using a larger number of securities in the underlying pool, a progressively larger fraction of the issued tranches can end up with higher credit ratings than the average rating of the underlying pool of assets
- For example, consider extending the two-bond example by adding a third \$1 bond, so that now three \$1 claims can be issued against this underlying capital structure
- Now, the first tranche defaults if any of the three bonds default, the second tranche defaults if two or more of the bonds default, and the final, senior-most tranche only defaults when all three bonds default
- If bonds default 10 percent of the time and defaults are uncorrelated, the senior tranche will now default only 0.1 percent of the time, the middle tranche defaults 2.8 percent of the time, and the junior tranche defaults 27.1 percent of the time.
- Thus, by including a third bond in the pool, two-thirds of the capital—as measured by the tranche notional values—can be repackaged into claims that are less risky than the underlying bonds

A Central Insight

- Another way to increase the total notional value of highly-rated securities produced is to reapply the securitization machinery to the junior tranches created in the first round
- For example, in the two-bond case in which defaults were uncorrelated, the \$1 junior tranche defaults with 19 percent probability. However, if we combine this \$1 junior tranche with an identical \$1 junior tranche created from another two-bond pool, we can again tranche the resulting \$2 of capital into two prioritized \$1 claims
- If there continues to be no correlation among underlying assets, the resulting senior tranche from this second round of securitization—a tranche that defaults if at least one bond defaults in each of the two underlying pools—has a default probability of 3.6 percent, which is once again considerably lower than that of the underlying bonds
- The collateralized debt obligations created from the tranches of other collateralized debt obligations are typically called CDO-squared—that is, CDO²

Uncorrelated Default Probability

- A key factor determining the ability to create tranches that are safer than the underlying collateral is the extent to which defaults are correlated across the underlying assets
- The lower the default correlation, the more improbable it is that all assets default simultaneously and therefore the safer the senior-most claim can be made. Conversely, as bond defaults become more correlated, the senior-most claims become less safe.
- Consider, for example, the two-bond case in which defaults are perfectly correlated. Since now both bonds either survive or default simultaneously, the structure achieves no credit enhancement for the senior tranche.
- Thus, in the two-bond example, while uncorrelated risks of default allow the senior claim to have a 1 percent default probability, perfectly correlated risks of default would mean that the senior claim inherits the risk of the underlying assets, at 10 percent.

Uncorrelated Default Probability

- Consider pooling a mortgage contract from New York with a mortgage contract from California
- Default probability should be independent
- However, in a major crisis defaults are correlated!

Credit Default Swap (CDS)

- A **credit default swap (CDS)** is a financial derivative or contract that allows an investor to "swap" or offset his or her credit risk with that of another investor.
- To swap the risk of default, the lender buys a CDS from another investor who agrees to reimburse the lender in the case the borrower defaults
- Most CDS will require an ongoing premium payment to maintain the contract, which is like an insurance policy

Credit Default Swap (CDS)

- A credit default swap is, in effect, insurance against non-payment
- Through a CDS, the buyer can avoid the consequences of a borrower's default by shifting some or all that risk onto an insurance company or other CDS seller in exchange for a fee
- In this way, the buyer of a credit default swap receives credit protection, while the seller of the swap guarantees the creditworthiness of the debt security.
- For example, the buyer of a credit default swap will be entitled to the par value of the contract by the seller of the swap, along with any unpaid interest, should the issuer default on payments.