

Over the past few decades, financial institutions have learned to customize their products to meet the specific needs of a diverse range of clients. Financial engineers combine the payments from a pool of assets into custom packages with risk attributes that specific investors prefer. These custom packages are commonly known as *tranches* (which means slice in French). Such *structured products* can increase the value of the underlying assets by distributing the risks to those best able to bear them. Investors can utilize these customized securities to diversify specific risks that they may face.

Until the financial crisis in 2007, structured products grew rapidly over the past decade, especially in the market for mortgage-backed securities (MBS). One prominent example is the *collateralized debt obligation* (CDO). A CDO is a security that returns a specific stream of payments from the assets that make up the collateral.<sup>1</sup> A typical CDO might have as collateral a range of MBS that, in turn, represents the stream of returns from thousands of mortgages. The outstanding volume of CDOs and similar products reached \$900 billion in 2007.

Slicing and Dicing Risk. By carefully designing the stream of payments and the collateral privileges, a bank or brokerage that issues a CDO can create a range of CDO tranches with very different return patterns and very different probabilities of default. So-called super-senior tranches were designed to pose even lower risk than high-grade corporate bonds, and were frequently awarded top ratings by credit rating firms. At the other end of the risk spectrum, the lowest-grade CDO tranches had substantial probability of default, and might have been issued without a rating.

Figure 1 illustrates the complexity and diversity of CDOs based on an underlying pool of subprime mortgages. In this example, the payments from a pool of 4000 subprime mortgages first provide the backing for a subprime MBS with a face value of \$1 billion. The five tranches of this MBS range from ratings of AAA to BBB-unrated according to their priority in receiving payments. Two structured CDOs (called high grade and mezzanine in Figure 1) are then formed from the MBS tranches. Each CDO is itself composed of six tranches that range in credit quality from senior AAA to unrated.

Figure 1 teaches us a key lesson: faulty risk assessment of the underlying mortgages will result in misjudgments about the structured products, too. At the same time, a CDO tranche may have different risk characteristics from the assets in the underlying pool.

To illustrate, imagine a series of 10 tranches that each receive an equal share of the payments from a pool of mortgages. However, the lowest-risk tranche has first

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<sup>1</sup> Collateral is the assets that are pledged to pay for a loan in the event that the borrower doesn't make the required payments.

priority on the payments, while the second tranche only receives a payment *after* the first tranche is fully paid. Similarly, the third tranche only receives payment after the second is fully paid. The sequence continues until the residual payments from the mortgage pool are distributed. In this setting, even if only 10% of the mortgages make timely payments, the lowest-risk tranche would *not* default.

To picture this tranche priority pattern, imagine a waterfall of interest payments from the underlying assets that pour into a sequence of buckets (tranches). The interest payments initially enter the bucket of the first tranche. Only after this bucket is filled, the interest payments spill over into the bucket for the second tranche, and so on down the line of buckets (tranches). If the payments are insufficient, buckets at the bottom go dry first.

Of course, this sequence means that the tranches at the bottom of the waterfall are riskier, even though they are based on the same assets as those at top of the waterfall. By adjusting the attributes of each tranche – including payment priority, collateral and other privileges – CDO issuers can customize a security’s risk characteristics to satisfy specific investor preferences.

However, financial alchemy (structured finance) cannot transform lead (risky assets) into gold (default-free securities). If all the underlying assets stop paying and the collateral becomes worthless, even top priority, over-collateralized tranches will fail.

And Figure 1 shows how losses on the riskiest portion of the underlying assets can trigger a default of some highly-rated securities. The “mezzanine structured CDO” in the figure is based on BBB- and BB-unrated subprime MBS that make up the riskiest 5% of the MBS pool. If that portion of the pool were to become worthless, even the senior AAA-rated component of the mezzanine structured CDO would default.

Growing Complexity. As structured products evolved in recent years, they became more and more complex and difficult to value. Other structured products also grew in volume. For example, collateralized loan obligations (CLO) allowed lenders to convert their loans into a security that could be customized, like CDOs, to meet the preferences of specific investors.

Role in Subprime Lending Boom. Structured products played an important role in the expansion of subprime mortgage lending during the housing boom because they made it easier to package these mortgages in a form that investors preferred. For example, investors who wished to hold low-risk assets with high credit ratings could purchase CDOs with a high priority in the payment sequence (e.g. at the top of the waterfall). The collateral may have included subprime debt that the investor would not have purchased directly. One estimate suggests that more than 80% of subprime

mortgages were used as a collateral for securities at the peak of the housing boom in 2005 and 2006.<sup>2</sup>

Role in Financial Crisis. Structured products also played an important role in the financial crisis of 2007-09. Complex, structured products lack transparency: it is difficult to see through the structure to the assets that make up their collateral. Consequently, in a crisis, structured products may prove difficult to sell or to value. At the start of the financial crisis, investors typically did not know what portion of the collateral for a CDO was composed of subprime mortgages from default-prone regions. As a consequence, the market for some structured products dried up.

Uncertainty about the value of structured products made it difficult to conduct business in other markets, too. Counterparties worried that financial institutions with structured products on their balance sheets might not be safe partners. Markets that had relied on highly rated structured debt as collateral could no longer do so. Officials were uncertain whether such financial institutions simply faced a need for greater liquidity (the ability to convert an asset easily into cash) or whether the decline in value of their structured products made them unsafe. The possibility that financial institutions might feel compelled to sell risky assets at depressed prices (a so-called *fire sale*) encouraged a vicious cycle of price declines, declines in net worth, and new pressures to sell assets (see Chapter 3 module: Leverage).

Inflated credit ratings contributed to the crisis impact from structured products. Some large financial institutions favored *super-senior CDOs* (supposedly better than AAA) because their high ratings satisfied at a low cost various government rules regarding the institutions' asset holdings. However, rating agencies vastly underestimated the probability of default on subprime mortgages, so that even super-senior CDOs were inadequately collateralized against default risk. Their loss in value severely undermined net worth in the financial system.

Structured products also made it unusually difficult to limit a wave of foreclosures and evictions as housing prices fell. In the past, when a bank typically owned a mortgage outright, it could sometimes avoid a costly foreclosure by negotiating with the homeowner to alter the mortgage. Such mortgage modifications are exceedingly difficult to arrange when, instead of one bank, many owners hold a tiny piece of the mortgage. Even when altering a mortgage would reduce overall costs, the mortgage service firms that can alter mortgages may fear lawsuits if they proceed. In part, this fear reflects that owners of CDO tranches with different risk attributes may have different views about mortgage modifications.

Other Problems. Finally, apart from the financial crisis, critics of structured products argue that they may be used for purposes other than diversification and risk management. For example, a financial institution might acquire a structured product

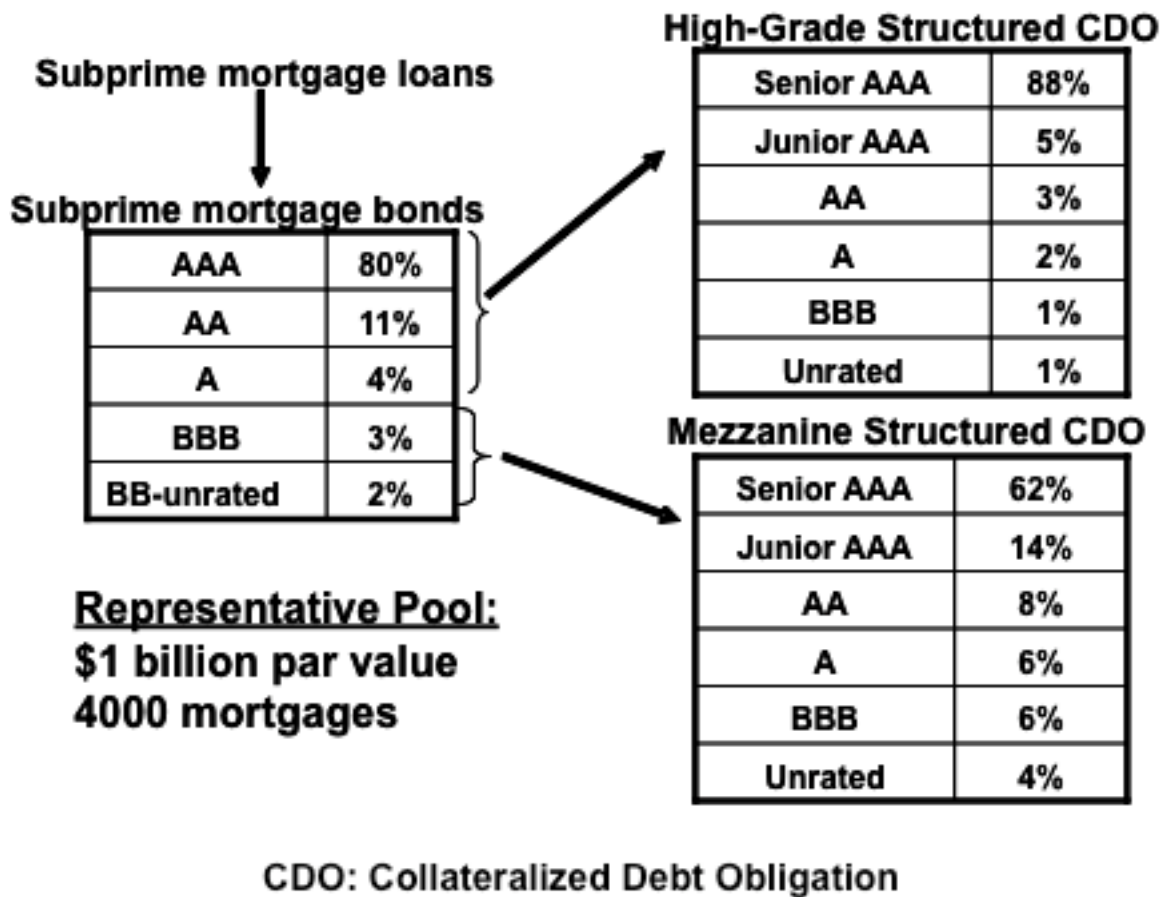
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<sup>2</sup> See Gary Gorton, "The Panic of 2007," in Federal Reserve Bank of Kansas City, *Maintaining Stability in a Changing Financial System*, August 2008.

to conceal risks or to achieve greater leverage or risk-taking than government officials favor. Some institutions also may use structured products to avoid or delay taxes.

Structured products are an issue for regulatory reform. For example, governments may wish to curtail the use of financial instruments that are not sufficiently uniform and transparent to trade openly on an exchange. The purpose would be to make users of structured products bear the potential costs to the financial system that the products may pose in a crisis. However, the financial crisis of 2007-09 already has revealed weaknesses of structured products and sharply diminished their use, so market forces may limit their re-emergence even in the absence of official policy changes.

Figure 1. Structured Finance



Source: Ashcraft, Adam B. and Til Schuermann, "Understanding the Securitization of Subprime Mortgage Credit," Federal Reserve Bank of New York Staff Report no. 318, March 2008.