
Structure Risk

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Financial professionals are very familiar with the typical forms of risk. Market risk, interest rate risk, basis risk, macroeconomic risk, operational risk, and sovereign risk are taught in the standard MBA curriculum. All of those sources of risk are known to affect portfolio value both directly and interactively and are regularly monitored by portfolio managers. All of those risks are also affected by information quality and therefore Akerlof's lemons discount problem that arises in the presence of imperfect and/or costly information.

Today's world of structured finance introduces a new source of risk: structure risk. Structure risk, like other traditional sources of risk, needs to be monitored and managed. Furthermore, structure risk – like other forms of risk – interacts with other risks and can introduce lemons discount problems in the presence of imperfect and/or costly information.

Auction rate markets are at a standstill because of a combination of structure risk and other risks. Investors fear not only the structures but also now the chance that the underlying collateral, in particular commercial loans and municipal bonds, and to a lesser extent, student loans, will be substantially affected by a recessionary scenario, which will stress credit quality.

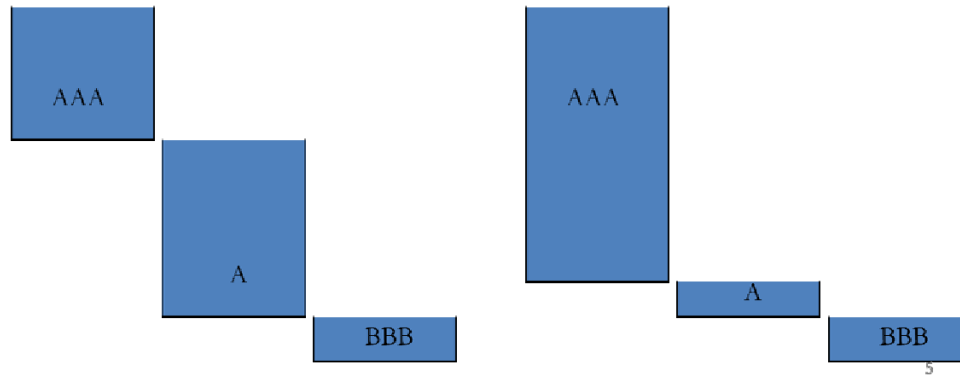
Structure risk is manifested in three key elements: financial engineering, granularity, and the predictability – simplicity tradeoff. Those three elements are introduced in detail below and form the basis of today's problems. With recession risk on the horizon, structure risk is interacting with macroeconomic risk, interest rate risk, and market risk to shut down markets in product areas based on even relatively safe collateral assets.

FINANCIAL ENGINEERING

Financial engineering is the process of developing a structure of securities – a capital structure – that appropriately distills the risk of a collateral pool into tranches of securities that can reasonably be expected to bear credit losses.

The heart of financial engineering is credit enhancement. The idea is simple. If the underlying collateral is more risky, add more credit enhancement. More credit enhancement insulates the top-ranked securities from the risk of loss. Figure 1 illustrates the concept. In Figure 1, the size of senior and subordinate classes may be altered to affect repayment probability for senior securities. The underlying pieces are a form of credit enhancement, or guarantee, for higher pieces.

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Figure 1: Credit Enhancement Waterfalls

If the pool of collateral assets is exactly the same for each of the structures depicted in Figure 1, the AAA-rated securities in the structure on the left are safer than those in the structure on the right. Alternatively, if the underlying pool of collateral assets in the pool on the left is riskier than those underlying the pool on the right, the AAA-rated securities of each may be equally safe.

PREDICTABILITY: HOMOGENEITY, GRANULARITY, AND HISTORY

Of course, the discussion of credit enhancement above begs the question of how to measure the riskiness of the collateral pool. There are three key elements of the pool that affect the ability to estimate risk: homogeneity, granularity, and history.

History refers to the historical experience with the collateral at issue. Relatively shallow databases of historical performance statistics, particularly those lacking experience through several economic cycles, gives financial engineers little performance variation with which to gauge future expected performance. In short, it is difficult to infer collateral pool performance without significant historical variation.

Even with historical experience, collateral performance may still be difficult to predict. The effect here is u-shaped with respect to the size of the pool. It is relatively easy to predict performance if there are only a few loans or many thousands of loans in the collateral pool. With few loans, investors can look directly at the credits to gauge performance. With tens of thousands of loans, statistical techniques will yield statistically valid inferences. In the middle, however, with too many loans to analyze individually but too few to derive statistically valid inferences, prediction becomes problematic.

Prediction can also be problematic if the loans in the pool are not homogenous. Underlying the statistical exercise is the assumption that all the loans in the pool are at least the same *type* of loan. It is easy to see why mixing, say, credit card, auto, and mortgage loans together in a pool would necessitate knowing (at least) the relative proportions of the mix and the different underwriting and servicing standards applied to each loan category.

It is also straightforward to see that subprime and alt-A mortgage pools containing unknown proportions of option ARM, high-LTV, and 80/20 loans (for

instance) would violate the homogeneity condition and therefore lead to problematic performance estimation. Adding to that relatively little historical experience with those loan types creates a nearly insurmountable barrier to successful securitization (see, for instance, Leon Kendall, *A Primer on Securitization*, MIT Press).

THE SIMPLICITY – PREDICTABILITY TRADEOFF

Limited predictability inherently constrains the credit enhancing exercise of financial engineering. The effect is different, however, from the financial engineering exercise discussed above. Limited predictability constrains not the ability to engineer a deal, per se, but rather limits the *complexity* of the deal.

Figure 2: Relationship between Predictability and Complexity

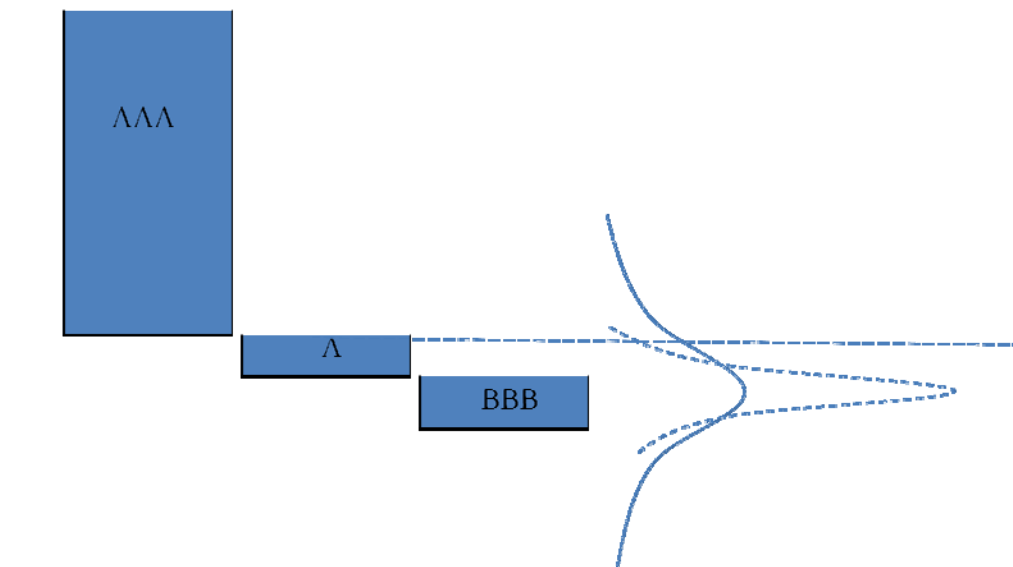


Figure 2 demonstrates the phenomenon. The effect is most easily thought of in terms of the standard deviations on the estimated losses resulting from the prediction exercise. (It is important to note, however, that one should not limit the analysis to standard deviations. For instance, with little historical experience the standard deviations will be suspiciously low.)

A predictable pool in Figure 2 is depicted as that with a narrow statistical distribution on losses, that is, a small standard deviation. A less predictable pool with same average risk is depicted with a much larger standard deviation.

On average, the BBB-rated piece will support the pool's risk. With the less predictable collateral, however, a relatively likely event – such as a one-standard deviation increase in defaults – will breach not only the A-rated piece, but also the AAA-rated piece. With the hard-to-predict collateral, the A-rated piece should probably be rated BBB (along with the lower portion) and the AAA-rated piece should probably be rated A (since it faces a significant chance of absorbing losses). The lower predictability can support only a two-piece deal, rather than three (and the top piece needs to be smaller to be properly AAA-rated).

With greater predictability (represented by the narrower statistical performance distribution), a one-standard deviation increase in defaults may impose some (but not total) losses on the A-rated piece, and those are highly unlikely to affect the AAA-rated piece even in a two- or three-standard deviation event.

In the real world, the performance of collateral like credit cards and auto loans is much more difficult to predict than that of prime conforming first lien mortgages. The reason is that credit cards have optional pay and teaser rate features that make it difficult to model performance with standard statistical models even though there is enough granularity in the pools. Many auto loans are written to high-LTV ratios that result in underwater conditions (where the loan is worth more than the collateral) for much of the loan's life, making prediction similarly difficult. Hence, credit card and auto loan pools are financed with very simple capital structures, typically consisting of three or four waterfall pieces and no esoteric features.

Traditional prime first-lien fixed-rate mortgage performance is relatively easy to predict (although I do not want to give the false impression that prediction is *easy*). Hence, such collateral supports structures with forty to fifty waterfall pieces and esoteric interest- and principal-only strips and PAC bonds.

Many recent subprime, alt-A, and second-lien mortgages share option payment, teaser rate, and high-LTV characteristics of credit cards and auto loans. Such mortgages, with relatively little performance history, lumped together in a heterogeneous pool, with many prediction difficulties, were sold not in simple structures like credit cards and auto loans but in complex structures approximating those of traditional first-lien fixed-rate mortgages. The problems in subprime and second-lien mortgage markets, then, are related to inappropriately complex structures.

INTERACTIONS OF STRUCTURE RISK AND OTHER RISKS

For some time now we have seen structured finance markets eviscerated by structure risk. Issuers, nonetheless, have been loath to simplify structures, because that could lead to lower deal yields (less cash from the sale of the resulting securities). Regulators, too, have been loath to enact reporting rules that adequately reveal the true extent and holdings of structured finance losses. Hence, structure risk premiums have been rising since last spring and show no sign of abating.

Those increased structure risk premiums initially shut down subprime mortgage markets. As the yield curve on structured credit flattened, markets – particularly highly leveraged structured finance markets that borrowed short-term to fund long-term investments, i.e., SIV markets – quickly shut down. Continued pressure on both the yield curve and structure risk, as well as the end of rating arbitrage (as the credit ratings agencies have been excoriated for their own role in creating structure risk) led to rapid downgrades for credit enhancers (i.e., the monoline bond insurers) which triggered contractual divestment thresholds in many short-term arrangements. Those trigger events are now affecting TOB and VRDO markets backed by safe municipal debt, among others.

Macroeconomic risk, in particular credit risk scenarios for commercial real estate, student loans, auto loans, and other loans in a recessionary scenario, are now shutting down other markets, as well.

The main point of the descriptions above is that for more than a year now the Fed has focused on macroeconomic risk to the exclusion of structure risk. The two are now beginning to interact in a potent brew. As macroeconomic risk and structure risk interact with credit risk, market risk, and interest rate risk the situation will become much more complex and difficult to resolve.