Benjamin T Solomon

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Loss Containment: Part 1 of 2, Portfolios **#9, April 2010**

Institute for Advanced Studies in the Space, Propulsion and Energy Sciences (IASSPES)

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To accelerate human achievement in the space, propulsion and energy sciences in the civilian sector.

Dear Benjamin Solomon,

First some good news:
1.Recognition: QuantumRisk is honored to introduce IASSPES (*Institute for Advanced Studies in the Space, Propulsion and Energy Sciences*) to the financial services community. The Institute's goal is to accelerate human achievement in space, propulsion & energy sciences in the civilian sector. IASSPES founded by Glen Robertson, organizes the SPESIF (*Space, Propulsion & Energy Sciences, International Forum*) conferences.

SPESIF papers are peer reviewed and the proceedings are published by the American Institute of Physics (AIP) as AIP Conference Proceedings. See SPESIF's 2009 & 2010 Conference Proceedings. SPESIF is a successor of the 28-year STAIF (*Space Technology and Applications International Forum*) conferences organized by the University of New Mexico.

Benjamin Solomon, should you be considering making a donation to a 501c(3) non-profit, I would definitely recommend IASSPES.

IASSPES is a 501c(3) non-profit. All donations welcomed.

Poetry Chapbook: The Hindu and The Punk (2009)

Cover art by Ken Zeromski

Poetry Chapbook: Please, God, Don't Let Me Write Like A Woman (2007)

Anushka A Solomon is recognized by Amnesty International (2007, 2008 & 2009) for speaking out against human rights injustices.

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What to Look Out for in Stress Testing

2. Data Supplier: We have finalized our CMBS data vendor, and are now in the process of extensive data testing.

3. Financial Advisory: QuantumRisk provides the following financial advisory services:
3.1 *CMBS Econometric Loss Vectors:* These are deal & time specific Excel 2007 worksheets consisting of 120 forecast loss distributions. More here. A suggested approach when using these vectors for the first time is to run concurrent comparisons with the existing vectors.
3.2 *CMBS Defeasance &Yield Maintenance:* For borrowers wishing to release properties from a conduit loan. Depending on the language in the loan document, CMBS loans may be paid off early through yield maintenance or through the substitution of collateral via defeasance.
3.3 *Municipal Refunding:* Many issuers can obtain significant savings by refunding or advance refunding their outstanding debt. Savings are affected by many factors including the spread between current rates and rates of the outstanding bonds, the amount of bonds outstanding, and the time remaining before the bonds are callable.

This month's theme is Loss Containment.

Loss Containment is quite a large topic, and is the theme of this & next month's topic. In Part 1 this month, we discuss how to reduce the impact of assets' long tails on a portfolio's loss distribution as the key to managing losses is to know your tails. In Part 2 next month, we discuss Fail-Soft in the financial services industry.

In our current environment, CMBS (*Commercial Mortgage Backed Securities*) & RMBS (*Residential Mortgage Backed Securities*) deals provide excellent examples of future foreseeable losses. Laurie Goodman highlights the possibility that 12 million families may be forced out of their homes within the next 2 years. Therefore, proactive loss mitigation is vital to the industry, *and* its customers. (Why? No customers, no industry.)

In this month's newsletter I explain a key concept, how to reduce the effect of loss tails to minimize their impact on AAA bonds in the CMBS deal structure. While we may not be able to reduce losses, we may be able to reduce their impact on the CMBS deal. Before we do that we may have to recognize that our current methodologies may be underestimating future losses, but not for the usual reasons. This discussion is based on my experience working with very large data sets and therefore, you won't find this in any journal or text book today. My rational is to present ideas & concepts that you, Benjamin, can test & verify without too much difficulty.

The Most Incisive Statement in 30 Months

Summary: 12 million families?

In the Feb 25 2010 Bloomberg article, Laurie Goodman, Senior Managing Director at Amherst Holdings LLC made the most incisive statement I've heard in 30 months, "*You can't throw 12 million people out of their homes*". Even for someone who specializes in downside risk, this statement got my attention.

I would add one tiny correction - 12 million *families*.

Using the reported January median home price of $164,700 and the assumption of an average low equity of 20% in these mortgages, $12 million foreclosures translates to $395 billion or $0.4 trillion loss of individual homeowners' wealth.

To give some idea of the size of this figure, it is about 2x that of the CMBS industry at its peak in 2007, and about 20% of the MBS (*Mortgage Backed Securities*) industry. This $0.4 trillion figure would suggest that optimistic near term economic forecasts are too rosy, and that foreclosures will continue to maintain a downward pressure on the availability of credit. The question we need to ask ourselves is, do we really want to destroy $0.4 trillion of other people's wealth?

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Some Thoughts on Default Methods

Summary: Asset defaults (ratio of events) are statistically different from dollar defaults (function of ratio of magnitudes).

Multiple Distributions: I had originally thought I'd just discuss long tails, but found that some matters needed to be clarified before discussing long tails. Individual asset losses have fat and long tails; the result of default and loss severities that obey binomial, lognormal or gamma distributions.

Default Methods: There are only 2 broad methods of determining default probabilities in the mortgage industry. The first default method is *asset default Pa* defined as the number of assets defaulted divided by the total number of assets in the portfolio. This is a statistic of *proportion or ratio of events*.

The second is what I term *dollar defaults Pd* (a.k.a. structural models). A dollar default is said to have occurred when the ratio of the *default boundary value* to *original value* decreases below a specific value. I use term them *dollar default* because they are primarily driven by the *ratio of magnitudes* to estimate credit risk; *severity of loss* and *1 - severity of loss* are examples. These are statistics of *proportion or ratio of magnitude* and we can term these ratios *severity of loss type statistic.*

Industry usage: The 2 ways this is used in CMBS are:

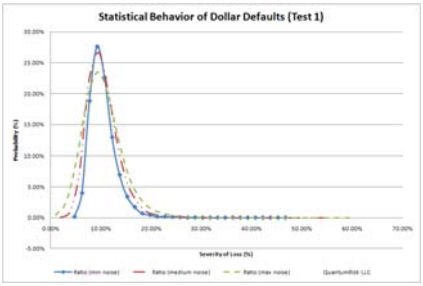
(1) CDR (Constant Default Rate): CDR is the ratio of *outstanding balance at default* (*default boundary value*) divided by *original principal balance (original value).* In CMBS deal structuring CDRs are presented as a time series of ratios a.k.a. loss vectors; *severity of loss* in its most basic form. There is no need to model defaults as they are assumed to have occurred (very neat!) and severity of loss is predetermined by the CDR statistic.

(2) DSCR loss models: A default occurs when DSCR gets below 1.0. Property cash flows are reduced by 2% (or some suitable value) per annum until this default event occurs. The *ratio of magnitude*, the ratio of the *outstanding principal balance* (*default boundary value*) to the *original principal balance* (*original value*) is determined when DSCR drops below 1.0. To determine *severity of loss*, the default event is specified by a *rate* of deterioration of cash flows, which is itself a *ratio of magnitudes*.

Empirical Data Confirms Biases

Summary: Empirical data confirms dollar default biases

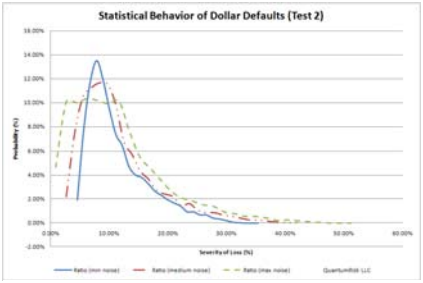
Empirical Confirmation: Empirical research (by others) confirm that dollar default methods (a.k.a. structural models) underestimate default probabilities. My own research on DSCR loss models concur with these results, that DSCR loss methods underestimate losses early in the life of a loan. My concern is not so much with these models' expected values as with the shape of their tails.



Test 1

Illustration: In a *non-rigorous* way we can illustrate why. Dollar defaults *Pd*, as a function of *proportion of magnitude*, have a different statistical behavior from asset defaults *Pa*, *a proportion of events*. We can see this by writing assets & dollar defaults, respectively, as some function of economic & industry factors *f(x)*:

Asset defaults as a function of economic and industry factors:
Pa = f(x) = number of default events / total number of assets



Test 2

Dollar defaults as a function of economic, industry and asset size, s:
Pd = g(f(x), s) = some function of ($ outstanding balance / $ original balance)

Using 2 portfolios to illustrate. Portfolio A consists of 2 assets of $100,000 each, and portfolio B consists of 3 assets of $100,000 each. Should one asset in each portfolio experience a loss (a good assumption if defaults are small) of $70,000, Portfolio A's loss is 35% (70,000/200,000) & B's is 23% (70,000/300,000).

Different Statistics: However, Portfolio A's asset default rate is 50% (1/2) and Portfolio B's is 33% (1/3) but their respective severities are 35% & 23%, and being less could result in an underestimation of asset default probabilities. But wait. Should the loss have been $20,000 then Portfolio A's & B's losses are 1% and 7% respectively, but the asset default would still be 50% & 33% respectively. That is, for each asset default there are multiple severity of losses, and therefore, dollar and asset defaults have different underlying statistical behaviors.;

The 2 figures (click on figures to enlarge) above, Test 1 & Test 2, show very different statistical distribitions that are dependent on the underlying nature of the risk drivers. It is clear from the graphs that the probability distributions of these *severity of loss type statistics* used to generate defaults, do not exhibit Binomial behaviors; Test 2 is not Lognormal, and Test 2's tail is much fatter and longer than Test 1's.

Alternative Explanation: Researches currently believe that this consistent underestimation of default probabilities is due to missing factors such as liquidity and recovery. But including recovery will only reduce the severity of loss statistic and would further depress the dollar default estimations. My analysis, however, suggests an alternative explanation for the underestimation, that of different statistical properties.

Undesirable Statistic: The dollar defaults statistical properties may even be undesirable. Using the form *sum of (probability of default x outstanding balance at default)* to estimate expected portfolio loss, we see that dollar defaults introduce asset size ***twice*** and asset defaults only ***once***. Therefore, dollar default methodologies may not be desirable for determining default probability.

Beta Distribution: An additional caution for those of you who model default & severity of loss. In my opinion, using the beta distribution is an assurance that your results are incorrect. Why? In my 30+ years working with large data sets, the beta distribution is the single most unstable distribution I have come across. This distribution will change shape when you are not looking! It is so unstable that small changes in its parameters can lead to significant changes in its shape.

Reducing Impact of Loss Tails

Summary: Portfolio's alter the shape of the tail for the better.

Therefore, we drop the use of dollar default methods. Most of us use portfolio diversification to reduce risk as measured by standard deviation of returns. But portfolios have little known

properties, they can reduce the effect & change the shape of long tails.

Severity Reduction: A portfolio consists of many assets, and each asset will have default probabilities and loss severities associated with it. All other factors being equal, the impact of a portfolio's tail loss can be reduce by increasing the number of assets in the portfolio. Using the 2 portfolios above to illustrate this; the severity of loss of Portfolio A is 35% but that of Portfolio B is 23%. The severity of loss to a portfolio is reduced by the size of the portfolio (given all other factors being equal).

Shape Change: Taking this a step further CMBS loss severities tend to be Gamma distributions while portfolio losses ought to approach Normal distributions (*but not quite*). Therefore for the same mean & standard deviation, the Gamma's tail can be 25 to 35 times longer than the Normal's tail. Why not quite?. In lay man's terms, the Central Limit Theorem justifies the approximation of large-sample statistics with the normal distribution, and therefore large portfolio statistics should look Normal. However, default probabilities tend to be small, in the 1 to 2% range. Therefore, there aren't enough observations to substantially shrink the loss tail, and therefore, appear lognormal or at least skewed to the right.

Cross Collateralized: Likewise, having multiple properties (cross collateralized) under a single mortgage can lead to catastrophic failure if there are a few properties. The loan defaults if a single property's loss of income causes the loan's DSCR to drop below 1.0. In this case a multiple property mortgage magnifies the effect of a single default. To reduce this impact one needs to either reduce the number cross collateralized assets in the deal or increase the number of properties in the mortgage. However, the latter is not a good solution as it defeats the purpose of deal structuring.

Spatial Correlations: Another problem with multiple property mortgages is that these properties tend to be in the same MSA (*Metropolitan Statistical Area*), and therefore are at risk to *spatial correlations* (see for example Prof. Tom Thibodeau, CU Boulder) that properties in close proximity tend to rise and fall together.

Multiple Liens: More obviously, the reverse is also true, multiple mortgages on a single property causes all loans to be in default should the property's income fall. In this case the mortgages should be assigned to different portfolios, thereby reducing the severity of loss to a specific portfolio.

Wrong Signals: Note that RBS has tried an approach to reduce underwriter's risk by not closing the loans as they are pooled. Interesting. While it does not reduce investors' risk, don't you think this sends the wrong market signals?

Some Lessons

Summary: Some lessons from a *loss perspective*.

1. Avoid single-mortgage-multiple-property (cross collateralized) assets.
2. Avoid CMBS deals with multiple cross collateralized assets.
3. Multiple-mortgages-single-property assets reduce risk for the same total principal.
4. My experience with CMBS data suggests that CMBS deals should be in the 150+ asset range. The RBS $309.7 million, 81 property deal is small, and it should be interesting to see how a small deal at the bottom of the market fares in the future.
5. Check your methodology.

About QuantumRisk LLC

We are ex-employees of GMAC/Capmark/Goff Capital Partners (Meet Our Team) and welcome

all business queries (970-306-7656), comments and feedback.

QuantumRisk is a boutique financial advisory & management consulting firm that provides the following services to investment companies, dealers & underwriters, fund managers, major municipal issuer(s) and corporate clients (no retail clients),

1. Structured Finance Support:
1.1 CMBS Econometric Loss Vectors & Black Swans (more).
1.2 CMBS Defeasance Structuring with Prepayment Charges and Yield Maintenance Analysis.
1.3 Municipal Tax-Exempt & Taxable Bonds Refunding Analysis including Escrow Analysis & Structuring.

2. Management Consulting:
2.1 Financial Analysis & Modeling
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Sincerely,
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