

CDOs-Squared Demystified

I. Introduction

February 4, 2005

Synthetic CDOs-squared offer investors higher spreads than single-layer CDOs but also may present additional risks. Their two-layer structures somewhat increase their exposure to certain risks by creating performance "cliffs." That is, seemingly small changes in the performance of underlying reference credits can cause larger changes in the performance of a CDO-squared. If the actual performance of the reference credits deviates substantially from the original modeling assumptions, the CDO-squared can suffer unexpected losses. We perceive four areas where synthetic CDOs-squared display particular sensitivity to actual performance being worse than assumed for modeling purposes: (1) frequency of defaults, (2) recovery rates, (3) correlation of default risk, and (4) distribution of defaults among the "inner CDOs" included within a CDO-squared. We address each of those below.

Investors in synthetic CDOs-squared weigh the wider spreads offered by the product against its incremental risk. We recommend a two-pronged approach for understanding the risk side of the balance. First, an investor should analyze the distribution of potential outcomes by using an appropriate computer model. That approach offers a big-picture view of potential performance, but it relies entirely on the particular model chosen and its underlying assumptions. Second, an investor should pursue a scenario analysis, examining specific "worst case" and "break even" scenarios as a reality check on the first approach. By combining both prongs, an investor can obtain a fair understanding of the incremental risk and select deals that offer the most favorable balance of risk and return.

II. The "ABCs" of CDOs-Squared

A CDO-squared, sometimes denoted as CDO² or CDO², is a type of collateralized debt obligation (CDO) where the underlying portfolio includes tranches of other CDOs. During the last couple of years, CDOs-squared, particularly of the synthetic type, have become an important segment of the global CDO market.

A. Types of CDO²

A *cash* CDO-squared is a CDO backed by a collateral portfolio consisting of tranches of existing cash CDOs.¹ On the other hand, a *synthetic* CDO-squared involves a portfolio of credit default

* Authors are grateful to Michael Van Bemmelen for providing valuable insights for this paper.

¹ In general, a CDO refers to an arrangement that issues bonds backed by a portfolio of bonds, loans, and other assets. For more basic concepts, please see, *CDOs in Plain English*, Nomura Fixed Income Research (13 September 2004).

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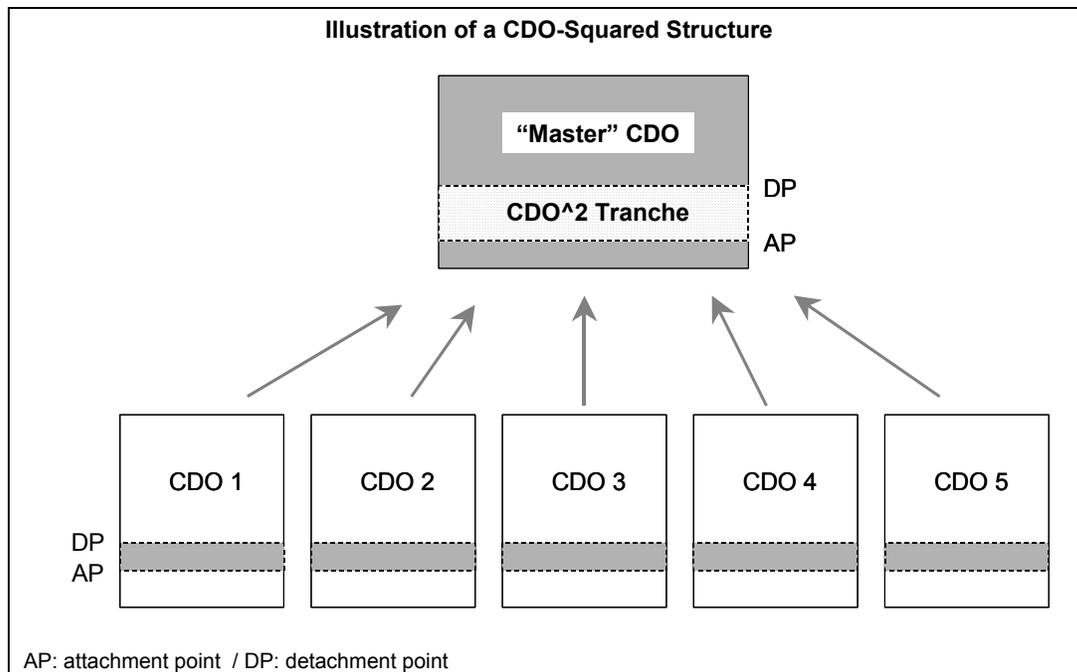
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swaps (CDS) and has a two-layer structure of credit risk. In most synthetic CDOs-squared, the underlying CDOs are created for the sole purpose of being included in the CDO-squared. Because of its synthetic nature, these underlying CDOs are simply conceptual and used to calculate cash flows and values of the CDO-squared. Therefore, a synthetic CDO-squared may be viewed as a complex derivative instrument, while its cash counterpart is simply a repackaging of existing CDOs. More recently, hybrid deals have begun to appear in the market. In these deals, a small portion of the reference portfolio is synthetic CDOs and the rest is cash or synthetic assets, such as ABS, RMBS or CMBS. However, given the typical high credit quality of those structured finance assets, most of the risk in hybrid deals stems from the CDO-squared part.

While synthetic CDOs-squared first appeared in Europe, the market segment experienced great growth in U.S. in 2004. According to S&P,² the number of U.S. synthetic CDO-squared deals jumped from just one in 2003 to 27 through the third quarter of 2004, with issuance volume of \$2.6 billion. By volume, CDOs-squared accounted for about 20% of all synthetic issuance and 4% of all CDO issuance in the U.S.

B. Basic Structure

A typical synthetic CDO-squared references a portfolio (sometimes called "master" or "outer" CDO) consisting of other synthetic CDO tranches (sometimes called "inner" CDOs). The underlying CDO tranches may have similar size and subordination, referencing similar portfolios. A CDO-squared usually comes with a certain amount of subordination, in addition to the subordination in the underlying CDO tranches. In the chart below, the lower shaded boxes represent the underlying CDO tranches, which collectively form the "master" CDO portfolio. The dotted box is the CDO-squared tranche. Tranches at the "inner" and "master" CDO levels come with separate attachment points (AP) and detachment points (DP), which define tranche sizes and subordination. Also, the inner CDO portfolios often include some of the same reference credits. The degree of this "overlap" is a very important factor determining the risk profile of the CDO-squared.



² Figures are from presentations at S&P's Annual Global CDO Conference, New York, November 1, 2004.

C. Rationale for CDOs²

There are mainly two reasons for using the double-layer structure. One is the higher degree of diversity achieved by including several underlying CDOs that already reference many corporate names. While a one-layer CDO typically references 50-100 corporate credits, a CDO-squared tends to include between five and ten of such one-layer CDOs. Another benefit of a CDO-squared is relatively larger spreads available for investors.

Given the double-layer structure, CDOs-squared are often perceived as having an added protection against losses, because tranches in underlying CDOs and the CDO-squared are protected by subordination at each level. However, higher spread levels achieved in the CDO-squared reflect the complexity and the unique characteristics of the instrument, which we explain below.

III. CDO² Mechanics

In a CDO-squared, losses are filtered through the double-layer of CDOs in the following manner:

- (1) Reference credit defaults in the underlying ("inner") CDO portfolios;
- (2) The corresponding inner CDO tranches suffer losses or lose part of their subordination, depending on the amount of losses;
- (3) If one or more of the inner CDO tranches suffer losses in (2), the losses flow into the master CDO portfolio;
- (4) The tranche of the master CDO suffers losses or loses part of its subordination, depending on the amount of losses in the master CDO portfolio.³

As an illustration of the deal structure, let us consider a CDO-squared created from three underlying CDO tranches. Suppose each underlying CDO includes 10 reference credits, equally weighted.⁴ For now, let's assume there are no overlaps, so the deal as a whole is exposed to 30 individual reference credits. Each underlying CDO tranche can withstand two defaults before getting hit with losses, but two additional defaults would wipe out the entire tranche.⁵

Losses at the underlying CDO tranche level would flow into the master CDO portfolio, which in this example consists of the three underlying CDO tranches. In other words, the master CDO is exposed to credit risk of up to six defaults. Also, the CDO-squared tranche is typically protected by its own cushion of subordination. If we assume that the CDO-squared has its own subordination sufficient to absorb one default, the tranche suffers losses only if more than one default flows into the CDO-squared portfolio, *after* one or more of the underlying CDOs has suffered more than two defaults.

Interestingly, the amount of losses in a CDO-squared tranche depends on not only how many defaults occur but also *where* they occur (*i.e.*, location of default in underlying CDOs). In the above

³ Mathematically, this process is expressed in the equation below:

$$\text{CDO}^2 \text{ Tranche Loss} = \text{Min} [\text{tranche size}, \text{Max} [0, \text{loss to underlying CDOs} - \text{subordination}]]$$

where losses to the underlying CDOs are calculated as:

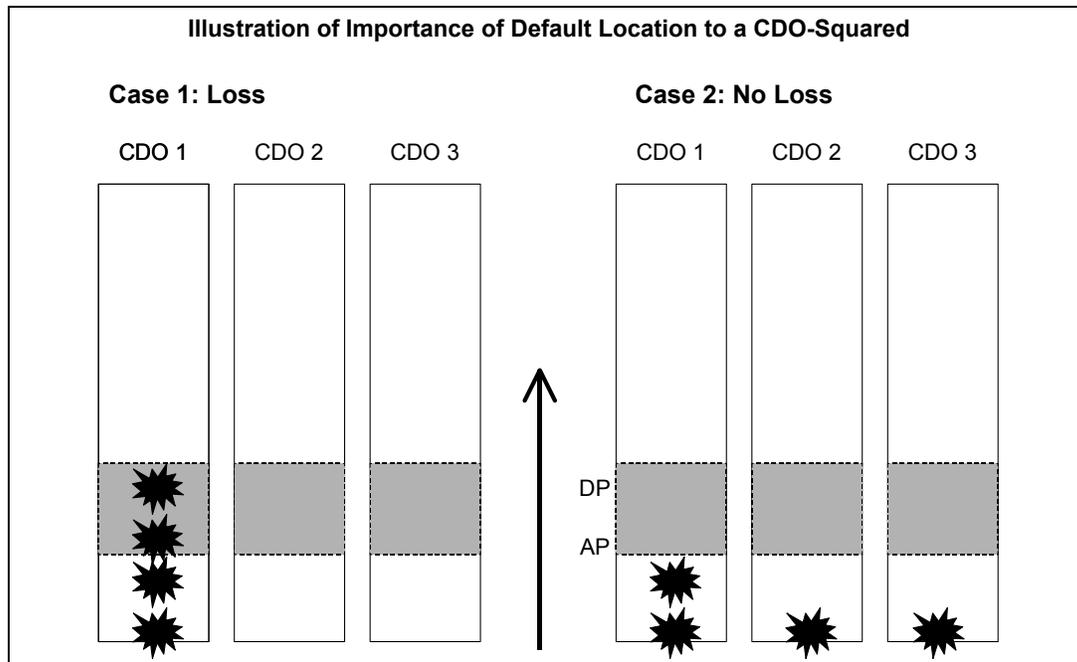
$$\text{Loss to each Underlying CDO} = \text{Min} [\text{tranche size}, \text{Max} [0, (\# \text{ of defaults}) \times (1 - \text{recovery}) - \text{subordination}]]$$

Note that tranche size and subordination is for the master CDO and the underlying CDO, respectively.

⁴ Note that the structure we discuss here does not reflect the typical deal structure seen in the market. A typical CDO-squared tends to include several underlying CDOs each referencing 50-100 names. Tranche thickness and subordination may vary, but typically range between 2% and 10%.

⁵ Here, we assume 0% recovery rate.

example, four defaults that are *evenly spread* across the three underlying CDOs will NOT cause any losses to the underlying CDO tranches (See Case 2 in the following chart). In such a case, one underlying CDO suffers two defaults and the other two suffer one default each, but losses do not reach any of the three tranches. In contrast, if all four of the defaults occur in just one CDO, it would wipe out that CDO tranche (Case 1 below). Furthermore, two additional defaults that flow into the master CDO portfolio exhaust the subordination at the master CDO level, causing losses to the CDO-squared.



Source: Nomura

The scenario we have just described highlights one difference between a CDO-squared and a regular CDO. In a regular CDO, only the *number* of defaults in the underlying portfolio determines tranche losses. In a CDO-squared, however, we need to identify exactly *where* defaults occur before we can identify whether or not losses have reached the CDO-squared tranche.

A CDO-squared is very sensitive to the *shape* of loss distributions of the underlying CDO tranches. The shape of loss distribution reveals the degree of "tail risk," or the likelihood of extreme outcomes. In a CDO-squared, credit risk in the underlying CDO tranches is already "tranching" and *another* round of tranching is made at the master CDO level. Accordingly, the double-layer structure amplifies the sensitivity of a tranche to various parameters, such as default probability, subordination, etc.

An obvious question for an investor would be, then, whether to stay with a regular CDO, that has a similar structure to the underlying CDOs we discussed above, or pick a CDO-squared that comes with a complex structure but offers a larger spread. In the following sections, we illustrate key characteristics of the CDO-squared.

IV. Examining Loss Distributions

There are many moving pieces in a CDO-squared. In this section, we will discuss each component of the deal structure that affects the risk profile of a CDO-squared. For illustration, we created a hypothetical CDO-squared and ran Monte Carlo simulations to generate correlated defaults among reference credits. We assume that the CDO-squared references a portfolio of five underlying CDOs, each referencing 50 corporate names. Subordination and tranche size are assumed to be

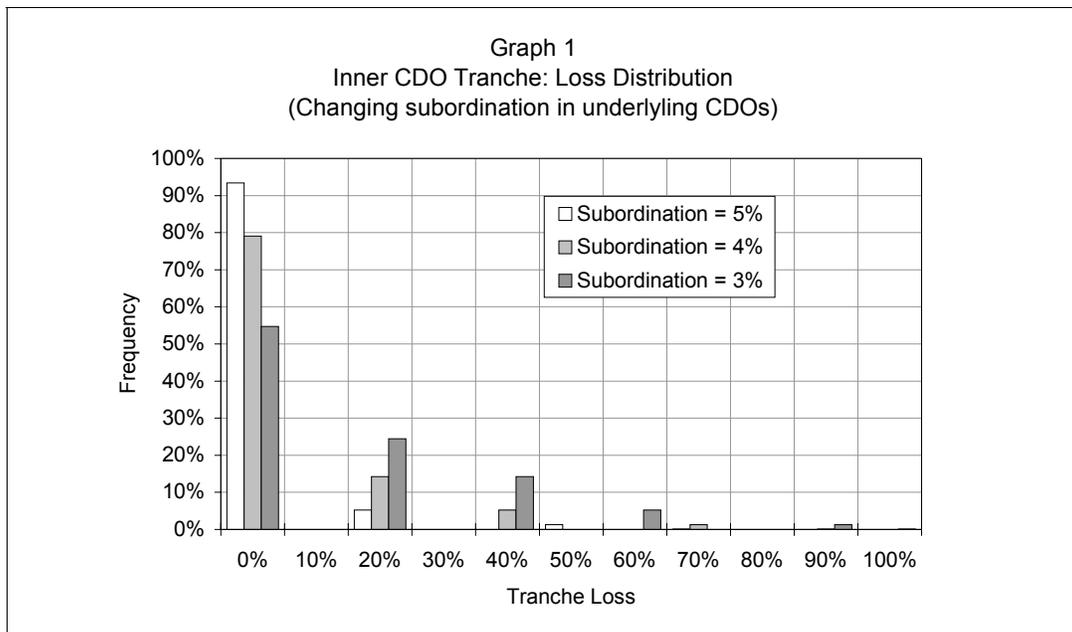
5% for both the underlying CDOs and the CDO-squared. Below, we used a 0% correlation and a 40% recovery rate unless otherwise noted. (See the table below.)

Hypothetical CDO ² Characteristics ⁶	
"Master" CDO	
Tranche size	5%
Subordination	5%
Underlying ("Inner") CDOs	
# of CDOs	5
Tranche size	5%
Subordination	5%
# of reference credits	50
Simulation	
Default probability	1.0% annually
Recovery rate	40%
Time Horizon	5 years
Correlation	0% uniform correlation for a base case (We also look at 20%.)

Source: Nomura

A. Loss Distribution of an Underlying CDO Tranche

As shown below, an underlying CDO tranche's loss distribution is mostly concentrated at 0% loss. It is a mezzanine tranche and does not suffer a loss until more junior tranches have been wiped out. However, as subordination declines from 5% to 3%, the likelihood of zero-loss declines, while the probability of incurring larger losses increases.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

⁶ Although it is often ignored, the CDO-squared structure involves gigantic reference portfolios in notional amounts. For example, suppose that the CDO-tranche sized at \$100 million represents 5% of the master portfolio and five underlying CDOs each represents 5% of the corresponding portfolio. It follows that the master CDO portfolio has a notional amount of \$2 billion (=100 million / 0.05). Moreover, the notional amount of each underlying CDO is \$8 billion (= 2 billion / 5 / .05)! These underlying CDOs are set up just to calculate the losses to the master portfolio, from which the CDO-squared tranche is created.

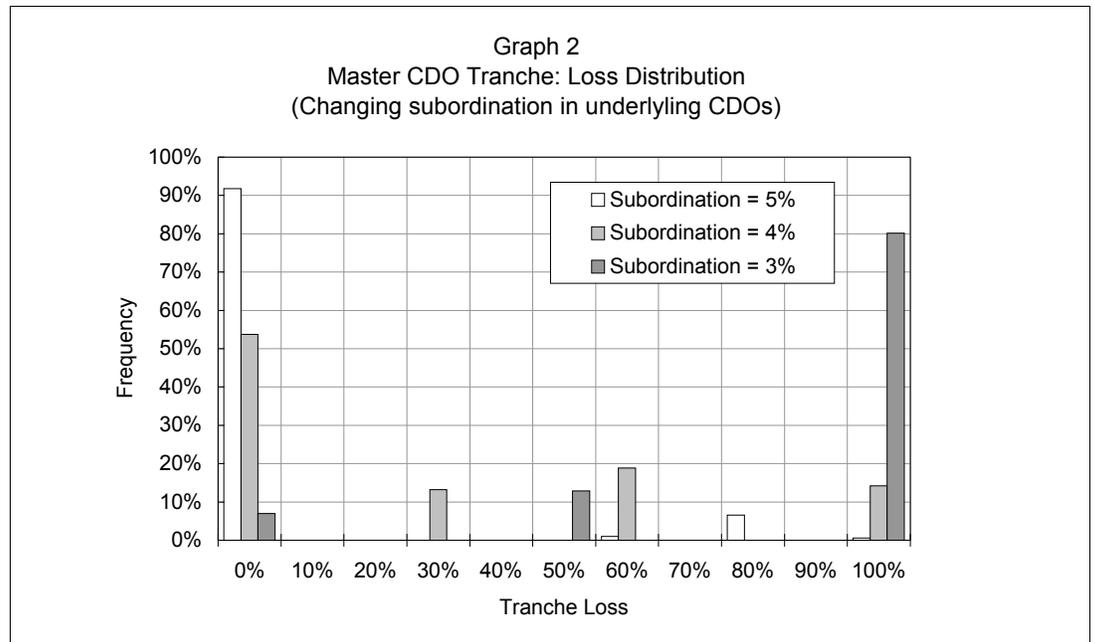
Tranche size is also an important factor affecting the risk of a tranching form of credit risk. As shown in the table below, a thinner tranche size increases the expected losses as well as the likelihood of a tranche wipeout. However, the effects are moderate. Also, note that the likelihood of non-zero loss (*i.e.*, losses reaching the tranche) is unaffected by varying tranche sizes, as it depends only on the tranche's subordination.

Table1: Effects of Changing Thickness of Inner CDOs (Simulation results)			
Tranche Thickness →	10%	5%	2%
% of non-zero loss	6.7%	6.7%	6.7%
% of tranche wipe out	0.0%	0.0%	1.4%
Expected losses	0.9%	1.7%	4.0%

Source: Nomura

B. Loss Distribution of the CDO-Squared

Any losses in the underlying CDO tranches flow into the CDO-squared and erode its subordination. Graph 2 reports the loss distribution of the CDO-squared tranche, with varying degrees of subordination at the underlying CDO level. Comparing this graph with Graph 1, we can see that loss distribution of the CDO-squared changes more dramatically as the amount of subordination changes at the underlying CDO level.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

Tranche size of the underlying CDO tranche is an even more important factor for the CDO-squared. As shown in the table below, the thinner tranche size of the underlying CDO tranches causes the expected losses and the likelihood of a tranche wipeout of the CDO-squared to increase significantly. Note also that thinner tranche size also affects the risk of non-zero losses for the CDO-squared, although it has no such effect on the underlying CDOs.

Table 2: Effects of Changing Thickness of Inner CDOs on CDO-Squared
(Simulation results)

Tranche Thickness →	10%	5%	2%
% of non-zero loss	0.6%	8.2%	32.2%
% of tranche wipe out	0.0%	0.6%	8.2%
Expected losses	0.2%	6.2%	32.2%

Source: Nomura

V. Other Risk Factors

Above, we showed that the CDO-squared tranche is highly sensitive to the characteristics of the underlying CDOs. Given such high sensitivity, there are additional factors, such as overlaps and correlation, which greatly influence the risk profile of a CDO-squared.

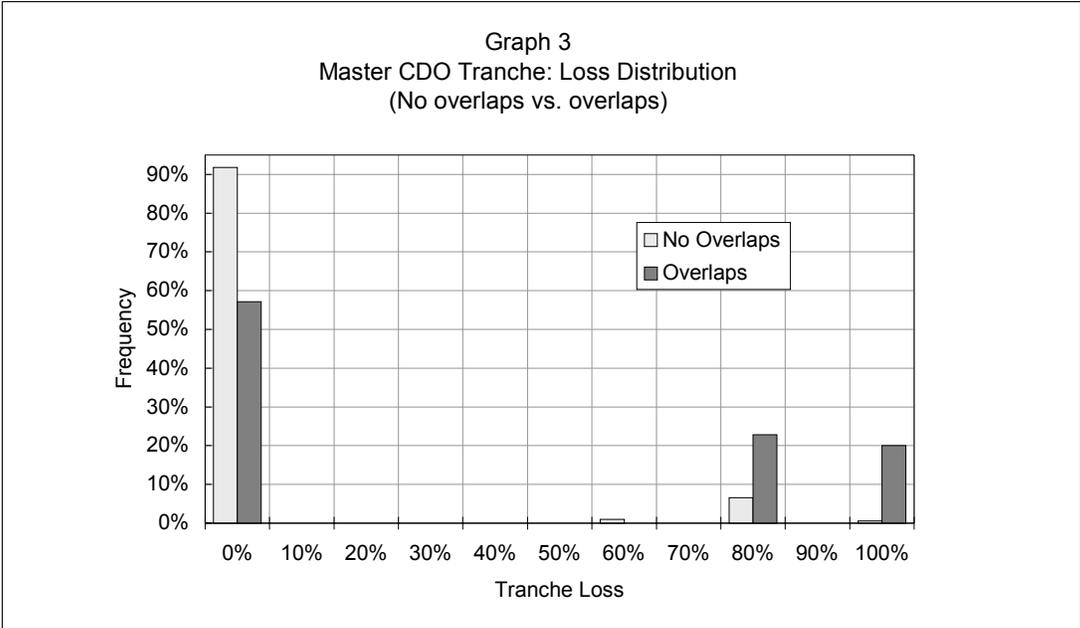
A. Effects of "Overlaps" in Reference Credits

Given the limited universe of actively traded credit default swaps (CDS), most CDO-squared deals have a structure where two or more underlying CDOs reference some of the same credits. This "overlap" tends to significantly alter the risk profile of a CDO-squared. For comparison, we create another CDO-squared, which is otherwise similar to the one we analyzed in the previous section, but which has 40% (50 out of 200) of reference credits appearing in two of the underlying CDOs. For example, CDO 1 and CDO 2 each reference ten overlapping credits that appear in both portfolios. The table below shows the numbers of reference credits that are commonly referenced by each pair of the underlying CDOs.

Table3: Example of Overlaps					
# of Overlaps	CDO 1	CDO 2	CDO 3	CDO 4	CDO 5
CDO 1	50	10			10
CDO 2	10	50	10		
CDO 3		10	50	10	
CDO 4			10	50	10
CDO 5	10			10	50

Source: Nomura

The next graph reveals that overlaps in the underlying CDOs cause the loss distribution to become "fatter-tailed." This is because overlaps have similar effects to having higher default correlation. In other words, the situation is similar to having two reference credits with a 100% correlation. However, unlike correlation, overlaps only affect the CDO-squared, not the underlying CDOs, that are separate from each other.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

In the table below, we can see that overlaps significantly increase the tail risk, or the probabilities of non-zero loss and tranche wipe out. Expected losses to the CDO-squared also increase significantly, from 6.2% to 37.4%, with 50 out of 200 names appearing in two underlying CDOs.

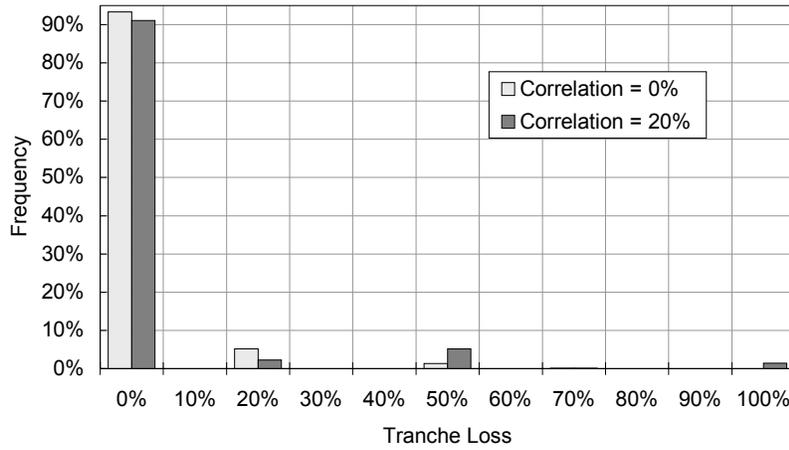
Table 4: Effects of Overlaps (Simulation results; 0% correlation)		
No overlap	% of non-zero loss	8.2%
	% of tranche wipe out	0.6%
	Expected Losses	6.2%
Overlap	% of non-zero loss	42.8%
	% of tranche wipe out	20.0%
	Expected Losses	37.4%

Source: Nomura

B. Effects of Higher Correlation in the Underlying CDOs

Higher correlation among reference credits in a regular CDO portfolio affects risk profile of various CDO tranches differently. Graph 4 and Graph 5 show that the CDO-squared is more sensitive to changing correlation than are the underlying CDO tranches. This is why the CDO-squared is sometimes described as a "correlation intensive" instrument.

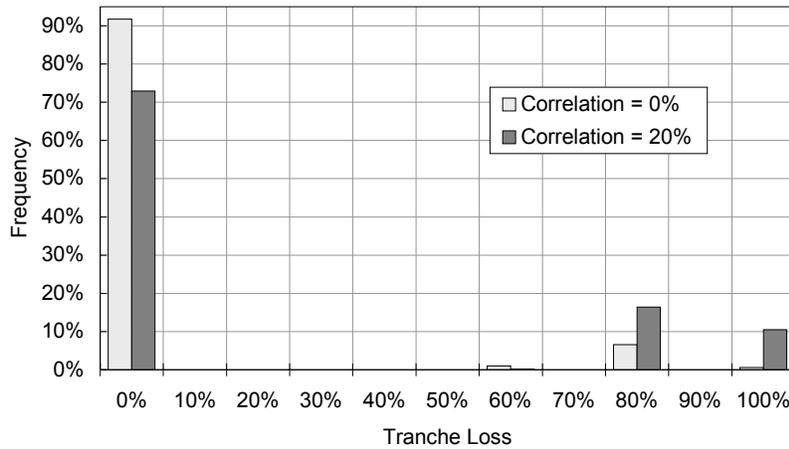
Graph 4
Underlying CDO Tranche: Loss Distribution
(Changing correlation)



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

Comparing Graph 3 and Graph 5, we can see that higher correlation and overlaps have a similar effect on the risk profile of the CDO-squared. With overlaps or higher correlation, the likelihood of large losses and tranche wipeout increases significantly.

Graph 5
Master CDO Tranche: Loss Distribution
(Changing correlation)



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

Also shown in the table below, higher correlation increases the tail risk, or the probability of a wipeout, as well as the expected losses, of a CDO-squared. Particularly alarming, the likelihood of a tranche wipeout increases from less than 1% to more than 10%, as correlation increases from 0% to 20%.

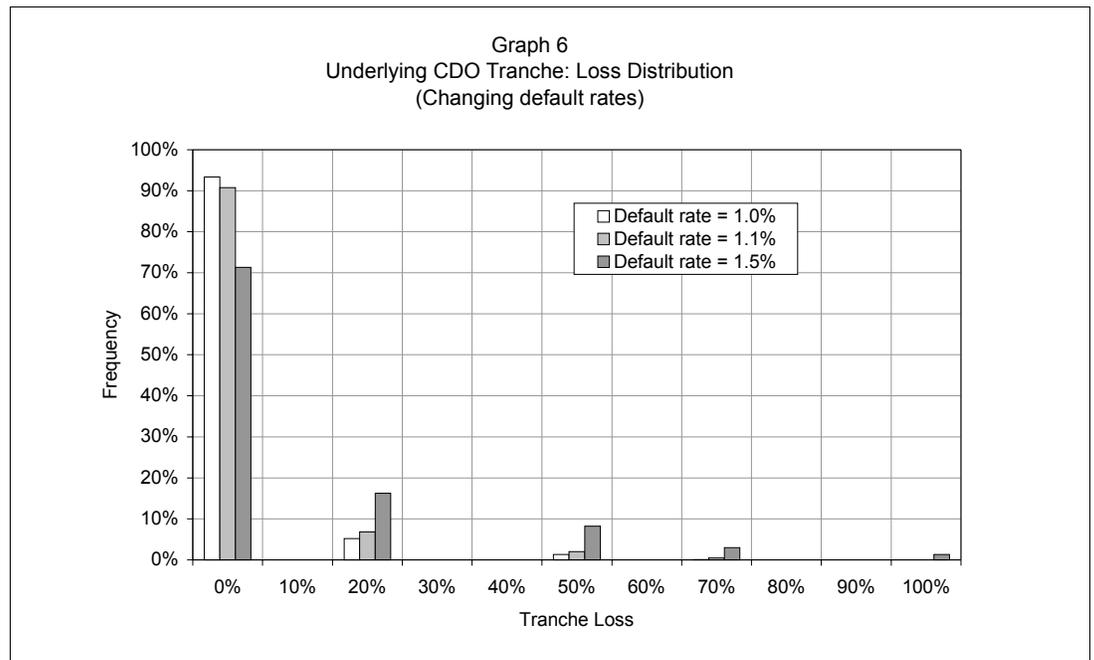
$\rho = 0\%$	% of non-zero loss	8.2%
	% of tranche wipe out	0.6%
Expected Losses	6.2%	
$\rho = 20\%$	% of non-zero loss	27.1%
	% of tranche wipe out	10.5%
	Expected Losses	23.1%

Source: Nomura

An obvious observation from the above results; overlaps and correlation are the key risk factors here that have similar effects on the risk profile of a CDO-squared. However, the degree of overlaps depends on a deal's structure and is visible at any time of the deal's life. In contrast, the correlation structure among the underlying reference credits is difficult to measure and is likely to change over time.

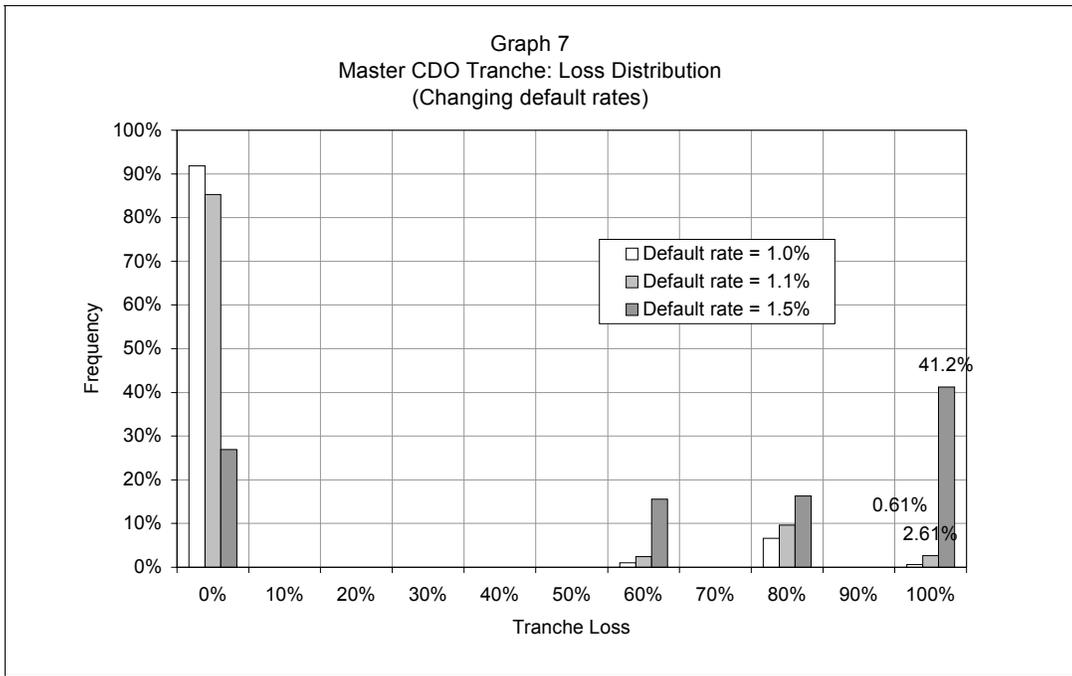
C. Effects of Changing Default Risk

Varying default rates affect the underlying CDOs as well as the CDO-squared. Higher default rates make a portfolio riskier and increase expected losses. We ran an additional set of simulation using a higher default probability of 1.1% annually, compared to 1.0% in our base case. Here again, higher default rates affect a CDO-squared tranche much more dramatically than the underlying CDO tranches. We can see in Graph 6 that the higher default rate causes the likelihood of higher losses to increase, but the loss distribution changes only modestly.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

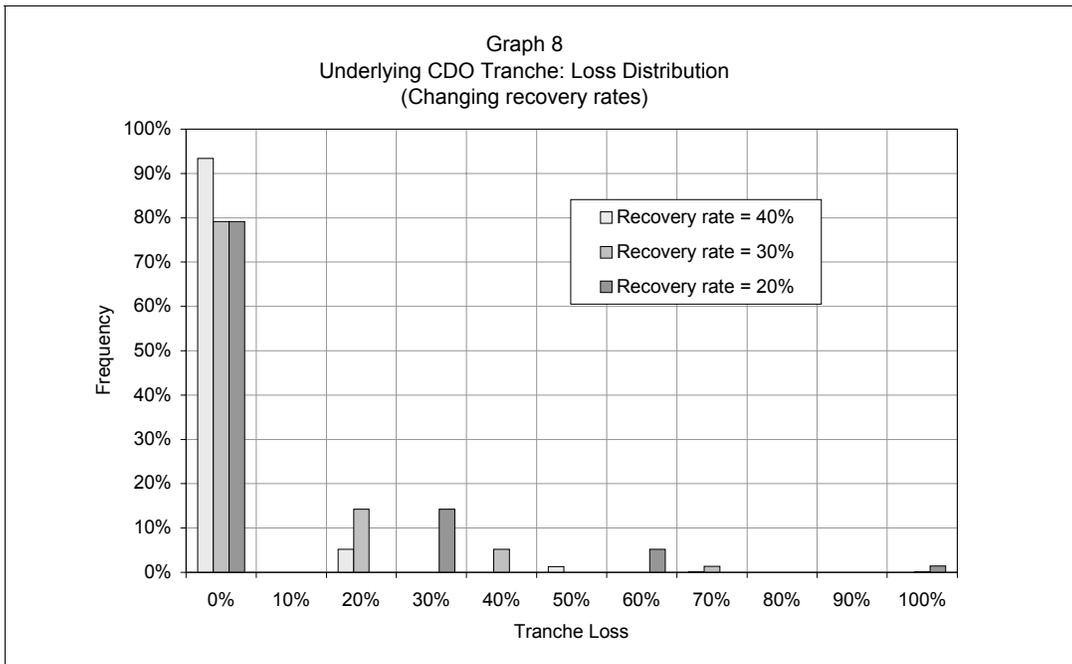
Graph 7 shows that the effect of higher default risk is more pronounced on the CDO-squared tranche. For example, the probability of a tranche wipeout goes up from 0.6% to 41.2%, as the default rate goes up from 1.0% to 1.5%.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

D. Effects of Changing Recovery Rate

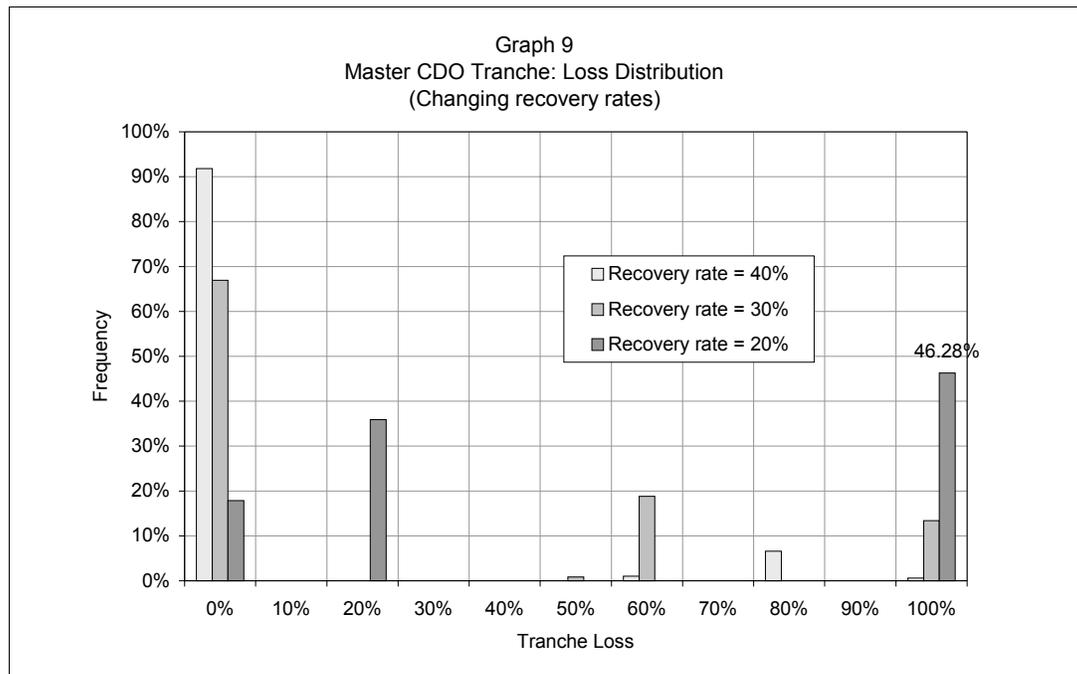
The level of recovery rate also affects both the underlying CDOs and the CDO-squared. A lower recovery rate means that each default causes a larger amount of loss. Once again, as shown in Graph 8 and Graph 9 below, a CDO-squared tranche is much more sensitive to the recovery rate assumption than the underlying CDO tranches, as the effects are magnified through the double-layer structure.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

While the loss distribution for the underlying CDO (Graph 8) changes somewhat with the various levels of recovery rate, the loss distribution for the CDO-squared (Graph 9) exhibits a significant

shift as the recovery rate goes down from 40% to 20%. Most notably, with a 20% recovery, the likelihood of a tranche wipeout jumps from less than 1% to 46.3%, highlighting the importance of a correct assumption about the level of recovery in a CDO-squared.



* Base case assumptions: tranche size/subordination of 5% for both the inner CDOs and the CDO-squared; recovery rate of 40%; annual default rate of 1%; time horizon of 5 years; and 0% correlation. Source: Nomura

E. Pulling All Together - The "Cliff" Risk and Scenario Analysis

CDOs-squared are often referred to as being subject to the so-called "cliff" risk, a phenomenon where the tranche gets wiped out quickly once losses reach it. To illustrate this point, consider our hypothetical CDO-squared with the five underlying CDOs referencing 50 credits each. Assuming a 40% recovery, each default wipes out 1.2% of the underlying CDO portfolio. Then, each of the underlying tranches, worth 5% of the portfolio, covers about four defaults. Since the master CDO consists of five such tranches, it withstands about 20 defaults. The CDO-squared tranche is protected by 5% subordination, and it can withstand one default in the master portfolio. However, given the tranche size of 5%, the second default in the master will completely wipe it out. (See the box below for a numerical illustration of this situation.)

A Numerical Illustration of the "Cliff" Risk

A CDO-squared is created from five underlying CDOs, each referencing 50 reference credits. Subordination and tranche size are set at 5% of the portfolio, both for the underlying CDO tranches and the CDO-squared tranche. If we assume the notional amount for each reference credit to be \$1, the notional amount of each "inner" CDO portfolio is \$50. The notional amount of each inner CDO tranche is \$2.5 (= 5% x \$50). Assuming a 40% recovery rate, each default causes 60 cents of losses. Each inner CDO tranche is protected by about four defaults (= \$2.5 / 0.6), but it will be wiped out by the ninth default, when losses exceed \$5 (\$0.6 x 9 = \$5.4).

The "master" CDO portfolio contains five inner CDO tranches, so the master portfolio's notional amount is \$12.5 (= \$2.5 x 5). The CDO-squared tranche represents 5% of the master portfolio and has subordination of 5%. This translates into tranche size and subordination of \$0.625 (= \$12.5 x 5%). With each default causing a loss of \$0.6, the CDO-squared tranche's credit enhancement and tranche size are equivalent of just one default!

The cliff risk is a manifestation of relatively thin tranche size, a common feature in the CDO-squared structure. Because of this risk, it makes a huge difference *specifically where* defaults

occur in the deal's structure. At this point, let us now go back to the chart on Page 3. Suppose two defaults have already occurred to CDO 1, completely erasing the tranche subordination. If the third and fourth defaults occur in the same CDO, the tranche would be wiped out. Then, losses will eat up half of the CDO-squared. On the other hand, if the next two defaults are spread out in CDO 2 and CDO 3, the CDO-squared would remain unimpaired.

For this reason, we think assessing various scenarios, from the worst to the best, is important when analyzing a CDO-squared. In the best case, defaults occur more evenly, using up all the available subordination in the underlying CDOs before the CDO-squared is hit with losses. However, in the worst case, a small number of defaults concentrated in just one inner CDO could wipe out the entire CDO-squared tranche, while leaving some of the subordination unused in the other underlying CDOs. The cliff risk may be exacerbated by various factors, such as high correlation, overlaps, and low recovery rate. Therefore, the worst/best case scenario analysis should incorporate these additional dimensions of risk.

The table below shows an example of scenario analysis, based on the hypothetical CDO-squared we discussed in the previous sections. The "random" case refers to a situation where defaults occur evenly spread across the underlying CDOs, using up the underlying CDO subordination efficiently. The "all overlaps" case is one stress scenario where defaults occur first in names that are overlapping. In such a situation, default of one credit causes losses that are equivalent to having two independent defaults. Finally, the "worst" case scenario refers to a case where, albeit a very remote occurrence, defaults are concentrated in just one underlying CDO, and hence losses hit the CDO-squared tranche while a substantial amount of unused subordination remains in other underlying CDOs. It is striking that in the worse possible case, default of just five out of 250 reference credits can hit the CDO-squared and, likewise, only seven defaults can wipe it out. However, the likelihood of such an extreme case is extremely small.

Scenario →	Random	All Overlaps	Worst
First \$ loss	22	11	5
Tranche wipeout	23	12	7

*Assuming a 40% recovery. Source: Nomura

VI. Rating Agencies' Approaches

All three of the major rating agencies now use Monte Carlo simulation when analyzing CDOs-squared.⁷ They simulate defaults of individual reference credits beneath the entire deal structure, rather than directly simulating losses in the underlying CDO tranches. While the fundamental approaches are very similar, each rating agency has different assumptions about default rates, recovery, correlation, etc.

Moody's rating approach is based on the amount of tranche losses. Each simulation run calculates tranche losses in the underlying CDOs, based on the number of defaults and assumed recovery rates. Once underlying tranche losses are collected, losses to the CDO-squared tranche are calculated, in order to determine the appropriate credit rating.

On the other hand, S&P and Fitch assign a rating to a CDO-squared based on the likelihood of the tranche suffering the first dollar of loss. That is, the likelihood that the loss amount exceeds the CDO-squared tranche's subordination.⁸ In this approach, the loss distribution obtained via Monte

⁷ All these agencies' CDO models are publicly available, free of charge.

⁸ Fitch calls this "exceedance probability."

Carlo simulation is transformed into a graph that depicts probability of losses exceeding a particular amount. Then, the particular probability is linked to a credit rating with the equivalent "default" probability. Finally, the required subordination can be determined based on the simulated loss amount, which corresponds to that probability.⁹

Given the complexity of CDOs-squared, small differences in assumptions and specifications could result in a significantly different risk assessment. For example, Moody's recent report shows that assuming a 0% correlation for inter-industry issuers cause a CDO model to significantly underestimate the required level of subordination for a tranche, compared with using their assumption of 3% inter-industry correlation. The study also finds that the effect is more amplified for a CDO-squared.¹⁰ This situation might invite a practice called "ratings shopping," where a particular rating agency is preferred because it assigns higher ratings to CDO-squared tranches for a given deal structure.¹¹

VII. Conclusion – What Questions to Ask?

In this report, we illustrated the basic structure of a CDO-squared and highlighted the main risk characteristics of this complex instrument. Given the rapid product innovation in the structured credit arena, we would like to emphasize the importance of analyzing the whole distribution, not just point estimates, of possible outcomes in assessing risk. This point becomes particularly relevant for CDOs-squared, given the double-layer structure that amplifies the effects of varying risk factors. Small variations in the performance of underlying reference credits can affect the performance of a CDO-squared in an amplified manner. For that reason, we recommend that investors adopt a two-pronged approach in analyzing a CDO-squared; (1) the use of a simulation model that provides a "bird eye's view" of the potential performance, and (2) a detailed scenario analysis of worst possible outcomes. Such an approach should allow an investor to make an informed decision as to whether the incremental spread offered by a CDO-squared adequately compensates the complexity and additional risk of this sophisticated product.

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⁹ For more details, see; Neugebauer, M., et al., *Analysis of Synthetic CDOs of CDOs*, Fitch Global Criteria Report (13 September 2004).

¹⁰ The report shows that, for a CDO-squared tranche with thickness and subordination of 5%, the required credit enhancement to obtain an "Aaa" rating is 34% with 3% correlation, but the required amount drops to 13.5% with 0% correlation. The figure was See, Marjolin, B., et al., *CDO Sensitivity to Inter-Industry Correlation*, Moody's rating methodology (28 January 2005).

¹¹ See for example, Fender, I. and Kiff, J., *CDO Rating Methodology: Some Thoughts on Model Risk and Its Implications*, BIS Working Paper No. 163 (November 2004) (available at <http://www.bis.org/publ/work163.pdf>).

VIII. Recent Nomura Fixed Income Research

Fixed Income General Topics

- U.S. Fixed Income 2005 Outlook/2004 Review (16 December 2004)
- ABS Gold Coast Report 2004: Coverage of Selected Sessions of ABS East 2004 (21 October 2004)
- U.S. Fixed Income 2004 Mid-Year Outlook/Review (1 July 2004)

ABS/CDO

- Student Loan ABS 101 – An Introduction to Student Loan ABS (26 January 2005)
- ABS/MBS Disclosure Update #6 (27 December 2004)
- ABS Credit Migrations 2004 (7 December 2004)
- Home Equity ABS Basics (1 November 2004)
- “The Bespoke [bispóuk]” - A Guide to Single-Tranche Synthetic CDOs (17 November 2004)
- Tranching Credit Risk (8 October 2004)
- CDOs in Plain English (13 September 2004)
- Correlation Primer (6 August 2004)
- ABS/MBS Disclosure Update #5: Reactions to the Comment Letters (4 August 2004)
- ABS/MBS Disclosure Update #4: Issues from ASF Sunset Seminar (13 May 2004)
- ABS/MBS Disclosure Update #3: Start Your Engines – Get Ready to Comment (10 May 2004)
- CDS Primer (12 May 2004)

MBS

- GNPL REMIC Factor Comparison (18 January 2005)
- GNPL Prepayments January Factor (13 January 2005)
- FHA/VA Monthly (11 January 2005)
- FHA/VA Monthly (3 December 2004)
- FHA/VA Monthly (2 November 2004)
- GNPL Prepayments November Factor (10 November 2004)
- GNPL Prepayments October Factor (15 October 2004)
- Special Report ERISA Reform (29 September 2004)

Strategy

- B-Notes and Mezzanine Loans: A Primer (3 February 2005)
- Is Housing Inflation Properly Reflected in the CPI Index? (3 February 2005)
- Trade Recommendation: Re-Evaluate 5-Yr FHLMC Holdings (27 January 2005)
- 5 Reasons Corporate Spreads Could Go Wider (20 January 2005)
- 2004 Cross-Sector Returns – Looking Sharpe (13 January 2005)
- MBS Market Check-Up: January Update (12 January 2005)
- Market Strategy 2005 Outlook/2004 Review (6 January 2005)
- US Consumer Chart Book (4 January 2005)
- 2005 Outlook and Chart Book (20 December 2004)
- California Housing by the Numbers (20 December 2004)
- MBS Market Check-Up: Mid-December Update (10 December 2004)
- CMBS Exposure to KB Toy Store Closings (16 November 2004)
- US Dollar Chartbook (12 November 2004)
- Super-Senior Classes: A New Trend in the CMBS Market? (8 November 2004)
- Basel II – Changing Bank Risk-Based Capital Requirements (8 November 2004)
- ABC's of CMO Floaters – Creation and Valuation (3 November 2004)
- Swap Spread Regression Model (1 November 2004)
- Is the Treasury Market Overbought? (29 October 2004)
- MBS Vega Durations (27 October 2004)
- Oil Prices – The Long Term Outlook (21 October 2004)
- Regional Home Prices – Part II (21 October 2004)
- TIPS: Underperformance Ahead? (7 October 2004)
- Regional Housing Markets – Some Hot, Some Not (23 September 2004)

Corporates

- Corporate Relative Value (1 February 2005)
- Corporate Weekly - For the week ended January, 28 2005 (31 January 2005)
- Lehman Index Additions (25 January 2005)
- GM Motors (20 January 2005)
- U.S. Corporate Sector Review - December 2004 (5 January 2005)

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