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CMBS Fusion Transactions: A Tradeoff between Credit Quality and Diversity

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Abstract
In recent years, fusion transactions have become the dominant structure in CMBS. Simultaneously, credit support has also come down materially. We find that part of the decrease can be attributed to the benefits of experience and the improving property type mix. However, the biggest factor contributing to the declining credit support is the inclusion of large investment-grade quality loans. These large loans reduce the total expected loss to the trust, but could also weaken the degree of diversification. To quantify the tradeoff between diversity and credit quality, we use Monte Carlo simulations to analyze the impact across the capital structure. Our key findings are:
• Improvement in credit quality benefits all classes.
• Diversification affects different parts of the capital structure differently; it helps the senior-most classes but could hurt equity holders.
• Though fusion transactions are less diverse, due to the presence of high quality large-loans, diversification benefits can be achieved through a relatively small number of large loans - typically less than 10.
• The resulting tradeoff for fusion transactions is that the improvement in credit quality often outweighs the reduction in diversity.
• A fusion transaction with S to 10 investment-grade large loans can effectively lower the required credit support relative to a pure conduit deal despite the reduced diversity.

Keywords
Cornell, real estate, CMBS, fusion transactions, mortgage pool construction, CMBS investment, real estate debt, Lehman Brothers, conduit loans

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Summary

In recent years, fusion transactions have become the dominant structure in CMBS. Simultaneously, credit support has also come down materially. We find that part of the decrease can be attributed to the benefits of experience and the improving property type mix. However, the biggest factor contributing to the declining credit support is the inclusion of large investment-grade quality loans. These large loans reduce the total expected loss to the trust, but could also weaken the degree of diversification. To quantify the tradeoff between diversity and credit quality, we use Monte Carlo simulations to analyze the impact across the capital structure. Our key findings are:

- Improvement in credit quality benefits all classes.
- Diversification affects different parts of the capital structure differently; it helps the senior-most classes but could hurt equity holders.
- Though fusion transactions are less diverse, due to the presence of high quality large-loans, diversification benefits can be achieved through a relatively small number of large loans - typically less than 10.
- The resulting tradeoff for fusion transactions is that the improvement in credit quality often outweighs the reduction in diversity.
- A fusion transaction with 5 to 10 investment-grade large loans can effectively lower the required credit support relative to a pure conduit deal despite the reduced diversity.

Part I – Examining The Fusion Trend

The Backdrop: Conduit Transactions Becoming Endangered Species

CMBS participants can often be heard lamenting the demise of the conduit transaction. Since the beginning of 2002, only 7 of 67 fixed-rate, diversified multi-borrower transactions can be classified as "pure conduit" (see Figure 1). In contrast, the four years prior to 2002 produced 49 conduit transactions, out of a total of 151. While the exact definition can be a bit elusive, for our purposes, a "conduit" transaction has the following key features:

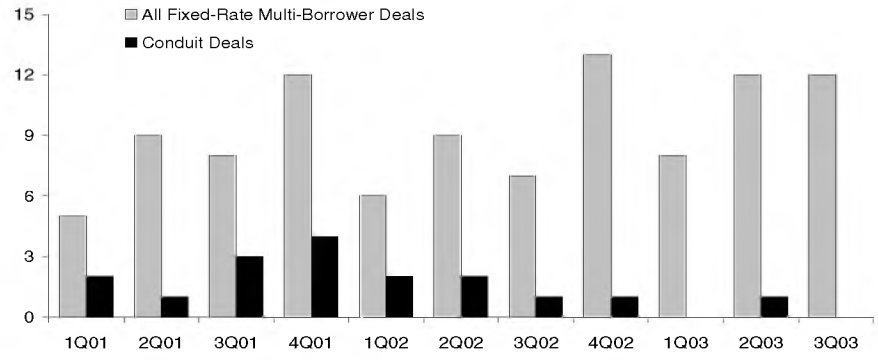
- Minimum of 100 loans
- Minimum securitization balance of $500 million
- No individual loan greater than 5% of the transaction balance at origination
- The top 10 loans aggregate to less than 30% of the balance at origination

There are a number of factors that contribute to the trend toward ***fusion*** transactions, the most significant being the 9/11 effect. The risk of a catastrophic event affecting a single-property transaction has taken on more meaning. Interest shortfalls, in part related to the costs of protection (e.g., terrorism insurance), have soured investor appetite for concentrated transactions. These factors have joined to drive execution to uneconomic levels.

But the need for large commercial loans hasn't evaporated; on the contrary, it has intensified. As interest rates have spiraled lower over the past few years, the pace of commercial property acquisitions has accelerated; institutional borrowers have rushed to place longer-term financing on their property portfolios. With the single-borrower/-property execution out of commission, originators have looked to other outlets for these loans. The outcome has been an increase in CMBS ***fusion*** transactions, where large commercial mortgage loans are combined with a broader, more diversified pool of conduit loans.

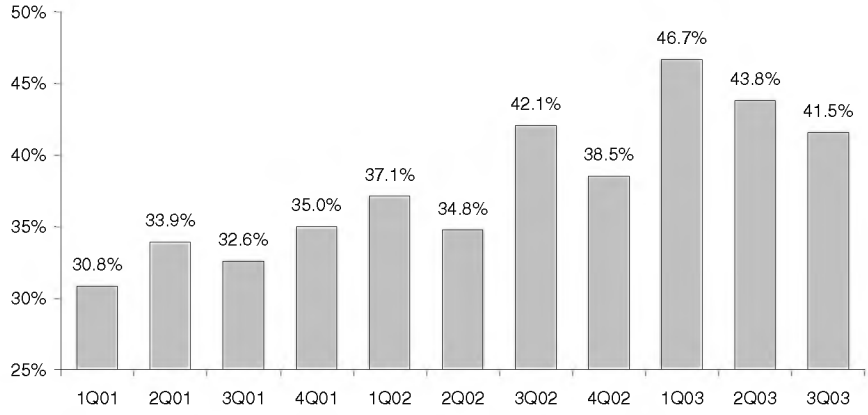
Figure 1: Pure "Conduit" Deals Approach Extinction

Number of Transactions Satisfying Conduit Criteria, by Quarter



Not all investors are enthralled with these developments. More than a few have expressed concerns about the potential for greater concentration risk in fusion transactions. As loan concentrations rise, investors are more levered to the performance of a specific loan. Since 2001, for example, the concentration of the top 10 loans in CMBS transactions has increased by more than 10%. Compared with the previous average of 30-35% in 2001, more recent fusion transactions have seen top 10 loan concentrations average 40-45% (see Figure 2). Proponents of the fusion structure base their arguments on risk mitigation: large investment-grade loans reduce the probability of a loss, A/B note structures alleviate event risk, diversification benefits are achieved with relatively few large-loans and well-capitalized institutional borrowers are more likely to support their loans. Which leaves us with the question: who's right? Are investors undervaluing a higher quality loan pool, or are originators raising the risk in CMBS transactions? In the following discussion, we'll explore the tradeoff between credit quality and diversification.

Figure 2: Top 10 Loan Concentration for Diversified CMBS Transactions



Source: Lehman Brothers

Framing the Debate: What's Driving Credit Support Lower?

We'll begin with some observations unlikely to shock anyone. Credit support on CMBS transactions has been trending lower for the past 5 years (see Figure 3). Since 1998, average AAA credit support on diversified, fixed-rate new origination CMBS transactions has fallen over 10%, from an average of 27.7% in 1998 down to 17.4% in 2003. The effect is more muted down the capital structure; single-Bs experienced only a token reduction in credit support. We elaborate more on this point in Part II of this publication.

Figure 3: Credit Support Spirals Lower, by Year of Origination

Rating	1998	1999	2000	2001	2002	2003	Since 1998
No. Deals	39	40	32	40	36	29	216
AAA	27.7%	26.3%	22.6%	21.2%	19.4%	17.4%	-10.3%
BBB	11.9	11.4	11.4	8.2	8.4	7.1	-4.8
BB	6.2	6.2	6.2	5	4.8	4.3	-1.9
B	2.6	2.7	2.7	2.4	2.4	2.3	-0.3

Source: Lehman Brothers

While the trends are obvious, the causes are somewhat veiled. A host of factors have contributed to declining credit support, redistributing protection across the capital structure:

- **Improving loan quality.** The quality of the loan pool has a considerable impact on the required credit support. It has been the most important driver of the decline since loss expectations are now lower on transactions. We separate loan quality into two categories: (i) the quality of the underlying ***conduit*** loans, and (ii) the quality of the large-loans incorporated into a ***fusion*** transaction. In both cases, there is clear evidence that credit quality is improving – driving credit support ***lower***. This observation requires a bit more explanation; we will elaborate in the next section.
- **Benefit of experience.** No one can argue that the rating agencies initially approached commercial mortgage loan securitization with considerable caution. Basing loan loss models on the early '90s real estate recession in Texas, the rating agencies structured protection to withstand volatile market cycles. As commercial mortgage lending has become more closely linked to the capital markets, a more disciplined approach has helped curb past supply excesses. All things considered, the rating agencies are adjusting their views to the realization that losses on securitized commercial mortgage loan pools will be lower than expected.
- **Improving asset mix.** To date, the loss experience on CMBS transactions has been far better than anticipated. Across transactions originated from 1996-99, aggregate losses remain less than 50 bp. With such low incidence of losses, performance has been more highly levered to weaker asset classes, most notably hotels, health care and credit-tenant leases (CTLs) (see Figure 4). For example, 50% of historical losses are tied to property types that account for only 10% of deal assets. Of the current non-performing loans, 43% have roots in these more volatile asset classes. As weaker (and more volatile) asset types are ferreted out of CMBS transactions, the probability of losses should also decline. Clearly, the CMBS market has limited deal exposure to these assets: since 1998, when hotel, health care and CTL loans accounted for 14% of deal originations, exposure has fallen to approximately 2.5%. Under the new tradeoff, deals have lower exposure to volatile assets, but are more concentrated in plain vanilla asset types like retail and office.

Figure 4: The Asset Mix is Less Volatile Now

Property Type	Non-Performing	Losses (% Orig)	Credit Indicator	Deals Originated In….. 1998	2003	Pct. Chg.
Retail	1.18	0.28	0.27	29.02	41.72	12.7
Office	0.71	0.1	-0.28	19.2	28.78	9.58
Multifamily	0.91	0.11	-0.5	25.48	17.52	-7.97
Hotel	7.34	1.22	6.77	9.95	2.27	-7.68
Industrial	1.61	0.07	0.33	6.68	4.91	-1.77
Other	1.17	0.05	-0.22	5.44	4.71	-0.73
CTL	3.8	0.96	2.99	1.97	0.09	-1.87
HC	8.89	1.7	6.74	2.26	0	-2.26
Overall	**1.66**	**0.28**	**0.61**	**100.00**	**100.00**	**0.00**

Source: Lehman Brothers

Trends in Quality: Conduit vs. Large Loans

Historical credit performance of securitized commercial mortgage loans suggests strong correlation between loan size and default probability: the larger the loan, the lower the probability of default. In Figure 5, we present evidence of the relationship between credit performance and loan size for fixed-rate, multi-borrower transactions. Cumulative losses are inversely related to loan balance; for example, loans originated with balances in the range of $50-$100 million have suffered only 3 bp of cumulative loss compared to 43 bp of cumulative losses for loans less than $10 million. Adjusted for loan age, we see the same general pattern: our credit indicator suggests that large-loans are performing 100 bp ***better*** than expectations while smaller "conduit" loans are performing approximately 100 bp ***worse*** than expectations.

Figure 5: Credit Performance Shows Clear Loan Size Effects

Loan Balance Range	Current Balance ($B)	Original Balance ($B)	60+ Delq. & Liquidations (%)	Cumulative Liquidations (%)	Cumulative Loss (%)	Credit Indicator
Less than $10 mm	107.3	123.7	2.56	0.81	0.43	0.95
$10mm-$30mm	68.4	74.8	2.42	0.57	0.22	1.19
$30mm-$50mm	19.7	21.3	1.14	0.17	0.17	-0.11
$50mm-$100mm	19.9	21.6	0.38	0.37	0.03	-1.11
Greater than $100mm	18.1	19.5	0.0	0.0	0.0	-1.0

Source: Lehman Brothers

Admittedly, there is an element of credit quality embedded in the results that's difficult to extract. Suffice it to say, larger loans tend to be backed by institutional borrowers with deep pockets. And, because they're typically originated with lower leverage, they're often shadow-rated investment-grade by the rating agencies.

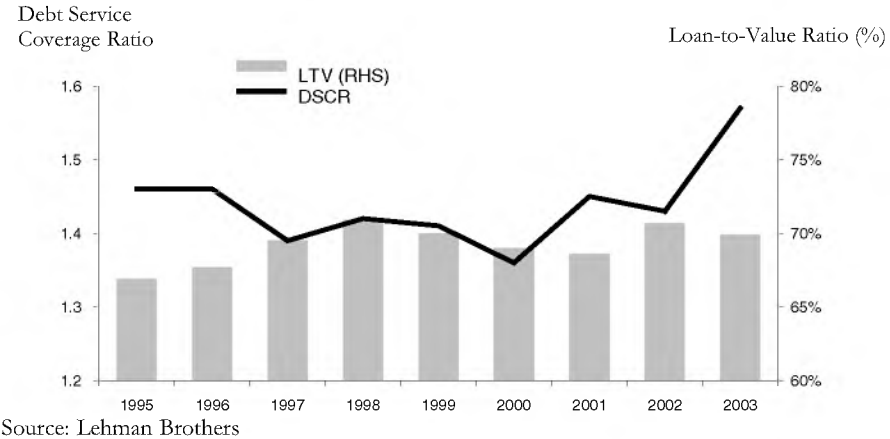
At the very least, history suggests that increasing loan size on conduit loans has been a favorable development from the perspective of quality. As shown in Figure 6, the average size of conduit loans is rising. More important, though, the average quality of conduit loans has also been improving. To prove this point, we aggregated origination statistics on (i) all loans in transactions defined as *conduit* and (ii) all loans less than $50 million from *fusion* transactions. Following a steady decline in debt-service coverage ratios (DSCRs) from 1995 to 2000, *conduit* DSCRs have subsequently resumed their ascent (see Figure 7). Through September 2003, the average DSCR at deal origination was 1.57x, 15% higher than the low point in 2000. Over the same period, *conduit* loan-to-value (LTV) ratios have been fairly steady, hovering around 69-70%. All these factors point to higher average quality for conduit loan pools now than in 2000.

Figure 6: Average Loan Size Keeps Climbing, $ million by quarter

Deal Type	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	2Q03	3Q03
Conduit	6.71	7.48	7.15	7.23	6.72	6.37	8.75	7.20	-	6.37	-
Fusion	7.07	7.30	7.62	6.59	7.81	7.49	10.42	7.97	10.15	9.34	9.92
Overall	**6.91**	**7.32**	**7.43**	**6.79**	**7.50**	**7.23**	**10.18**	**7.92**	**10.15**	**9.07**	**9.92**

Source: Lehman Brothers

Figure 7: Conduit Loans - DSCRs are on the Rise



Source: Lehman Brothers

The rating agencies seem to agree – credit support on *conduit* transactions continues to decline. In Figure 8, we track trends in credit support on transactions defined as pure *conduit* according to our criteria specified earlier. Not surprisingly, credit support on conduit loans has been declining in a similar fashion to trends across all fixed-rate CMBS assets, though the impact is less dramatic. Compared with the 10.3% decline in AAA credit support shown for all fixed-rate transactions in Figure 3, AAA credit support on *conduit* transactions has fallen only 7.6%. On BBB classes, *conduit* credit support has fallen 3.6% as compared with 4.6% for all fixed-rate multi-borrower transactions. While the rating agencies are telling us

that their outlook for expected losses on conduit/fusion transactions has improved, the results suggest that the key element that separates *conduit* from fusion is the quality of the large loans added to the pool.

Figure 8: Credit Support on Conduit Deals, by Year of Origination

Rating	1998	1999	2000	2001	2002	2003	Since 1998
No. deals	18	16	8	7	3	1	53
AAA	28.6%	27.2%	24.0%	22.4%	22.1%	21.0%	-7.6%
BBB	12.9	12.0	10.8	10.0	10.2	9.3	-3.6
BB	6.6	6.5	5.9	5.6	5.8	5.1	-1.5
B	2.9	3.0	2.6	2.7	3.1	2.9	0.0

Source: Lehman Brothers

An Intuitive Approach to Expected Losses

How do we quantify the effects of declining credit support? An intuitive approach is to use CMBS transaction structures to calculate the implied expected loss on a deal, and then track trends over time. This premise is rooted in the agencies' approach to rating securities, where the basic building block to a quality grade is expected loss. ***The expected loss assigned to a specific quality grade is uniform across assets and sectors.*** For example, if a CMBS security backed by office loans is rated BBB, then the expected loss on that asset is the same as the expected loss on a BBB rated corporate bond. Using the bond balance allocated to each rated class, and mapping the expected loss per quality grade, we can calculate the implied loss expected on a transaction. In Figure 9, we present a detailed example for a CMBS *conduit* transaction with a 10yr average life.

Figure 9: Calculating the Implied Loss Rate on a Conduit Transaction-JPMCC 02-C1

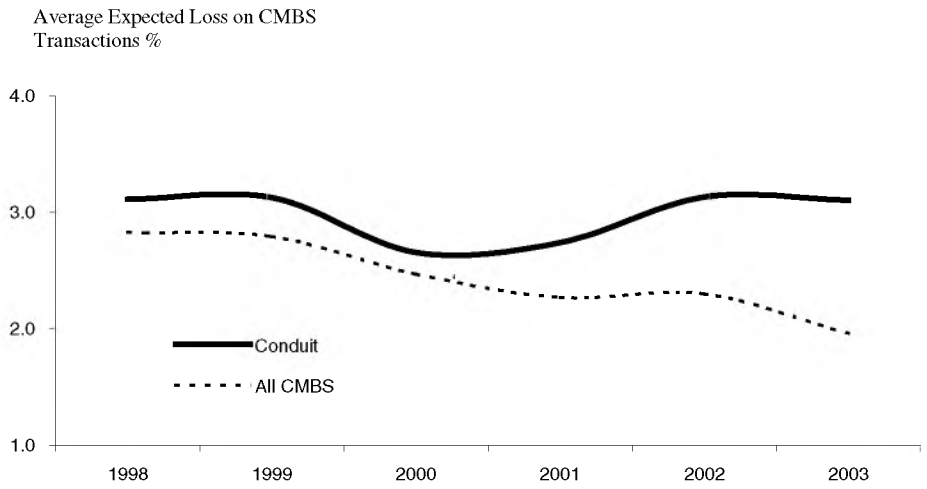
Deal Class	Rating	Orig. Bal ($000)	Orig C.E. (%)	*Exp. Loss (%)
A1	AAA	50,000	22.2	0.006
A2	AAA	174,000	22.2	0.006
A3	AAA	410,948	22.2	0.006
B	AA	30,624	18.5	0.11
C	A	34,708	14.2	0.66
D	A-	10,208	13	0.99
E	BBB	24,500	10	1.98
F	BBB-	12,250	8.5	3.355
G	BB+	16,333	6.5	5.17
H	BB	12,249	5	7.425
J	BB-	6,125	4.3	9.175
K	B+	4,084	3.7	12.21
L	B	8,166	2.8	14.96
M	B-	4,083	2.3	19.195
NR	NR	18,375	0	100

* Expected Losses per Moody's guidelines

Deal Expected Loss [Σ(Orig Bal)*(Exp Loss)/ Σ(Orig Bal)]	3.00%
Loss Severity Assumption	35%
Default Probability [Expected Loss / Loss Severity]	8.58%

Our intuitive approach suggests the rating agencies' anticipated losses to be in the range of 3% for the JPMCC 02-C1 *conduit* transaction. Using a standard loss severity assumption of 35%, we calculate a cumulative default probability of 8.58% over the term of the loans. Since all the loans in the transaction met the criteria for *conduits*, we infer that the average quality of a conduit loan is approximately BBB-/BB+ in that transaction. Note that this BBB- rating is not directly comparable to the shadow rating that agencies apply to loans. A shadow rating typically refers to the rating that would be applied to the junior-most cash flows of the loan. So, 'shadow' rating on a loan with an average quality of BBB- would be lower than BBB-. This is consistent with our findings when we apply our approach to a cross-section of the CMBS universe. In Figure 10, we group deals by vintage year and transaction type (i.e., pure conduit versus all fixed-rate, multi-borrower CMBS). It's clear from the results that expected losses on CMBS transactions have been declining over time – newer deals are structured with the expectation that cumulative losses will be ***lower***.

Figure 10: Rating Agencies Anticipate Lower Losses



Source: Lehman Brothers

Clearly, the rating agencies are implying that the average credit risk on transactions is falling. In 1998, the average transaction was structured with the expectation that cumulative losses would approach 3%. Today, similar transactions are structured with the expectation that losses will only approach 2%. We've already isolated the impact specific to conduit loans, but it doesn't fully explain the decline in credit support. The true driver of lower credit support is related to the increasing presence of large investment-grade loans.

Part II – Quantifying The Tradeoff: Credit Quality vs. Diversification

The credit quality of fusion transactions is clearly better than traditional conduit transactions: the large-loan sub-pool typically consists of investment-grade loans that are shadow-rated by the rating agencies. Of those large-loans rated in fusion deals during the first three-quarters of 2003, which amount to approximately 20% of total transaction balances, 8% were rated AAA, 20% were rated AA, 33% were rated A, and 39% were rated BBB.

The optimists' perspective is that high quality large loans reduce the total expected loss to the trust. The pessimists claim that loan concentration weakens the degree of diversification and introduces greater event risk. In reality, the above mentioned factors may impact the capital structure in conflicting ways. We'll show that better loan quality is beneficial to all classes, while loan concentration can benefit the subordinate classes, and hurt the AAAs. Our aim is to quantify the tradeoff between diversity and credit quality; and assess the different risks in the capital structure.

In our approach, we construct a sample fusion deal. We utilize Monte Carlo simulations to calculate the expected loss to each class, investigating the effect of diversity versus the quality of large loans. We find that the benefit of including large-loans of high credit quality easily outweighs the diversity concern to the AAA class. Additionally, diversity benefits are easily achieved: two-to-five investment-grade large-loans would significantly reduce the credit support required for AAA bonds compared with a pure conduit transaction despite the reduced diversity.

The Impact of Credit Quality and Diversification

First, we need to build an understanding of the roles of credit quality and diversification in a conduit transaction. How do we measure credit quality and diversification of a pool? How do these factors impact the trust as a whole, as well as various parts of the capital structure?

Measuring Credit Quality

There are many factors that determine the credit quality of an individual loan in a pool, including property quality, property type, quality of borrowers and tenants, loan to value ratio, DSCR, etc. In order to build a quantitative model to analyze the effect of credit quality, we need some simple measures that can capture these factors. **Default probability** and **expected loss** severity together serve this purpose. A high quality loan has a low chance of defaulting and is expected to have a low loss severity in the event of liquidation. If we know the average default probability and the expected loss severity of the loans in a trust, we can determine the total expected loss to the trust, which is simply the product of default probability and loss severity. For instance, if the average default probability is 10% and the average expected loss severity is 35%, the overall expected loss to the trust will be 3.5%. Obviously, high credit loans lower the expected loss to the trust.

Measuring Diversification

The level of diversification of a pool depends upon factors like geographic and property type concentration, among other factors. Quantitatively, diversity can be measured by the **number of loans** in the pool, **loan sizes**, and the **correlations** among the loans. It is important to note that diversity does not affect the expected loss to the trust. Rather, ***diversity determines the volatility of the loss.*** A highly concentrated pool has very high loss volatility, in the sense that the loss will tend to be either very high or very low. For instance, let's compare the extreme case (a single loan pool) versus the diverse case (a large number of loans) where each "pool" has the same default probability (10%) and loss severity (35%). The expected loss to the trust in both cases is the same (3.5%), but the single loan deal suffers a 35% loss 10% of the time, while experiencing no loss in 90% of the scenarios. In comparison, the diverse pool will experience around 3.5% losses in most scenarios. From the perspective of the equity investor holding the lowest 2%, a loss of 100% of principal can be expected in all scenarios for the diversified pool, while a loss of 100% of principal can be expected only 10% of the time in the single loan case.

Credit quality controls the expected loss while diversification determines the loss variability. The result is that they have varying effects across the capital structure. *Strong loan quality* – and thus low expected loss – benefits all classes. *A diversified pool* – and thus low loss variability – benefits senior classes. On the other hand, subordinate classes gain from a less diversified pool with high loss variability, since they have some probability of suffering no loss. We will demonstrate these cases in the following sections.

The Basic Approach: Conduit Transactions

Before getting to our analysis of *fusion* transactions, it is helpful to consider the simpler case of a *conduit* transaction, which allows us to demonstrate our methodology and serve as a base case for comparison.

Monte Carlo Approach

We construct a sample *conduit* deal with a principal balance of $1 billion. Our pool consists of 200 loans, each $5 million in size. We assume that all loans have the same average quality. To test the effect of credit quality, we vary the default probability of the loans between 5% and 30%. To investigate the effect of diversity, we alter the correlations among the loans between 10% and 40%. Keeping the number of loans and loan sizes fixed, lower correlation would imply a higher level of diversification. Using the technique of Monte Carlo simulation, we generate correlated defaults for the loans in the pool and compute losses based on a 35% severity assumption. The losses are distributed to each class based on assumed credit enhancement levels. We run 50,000 simulations to find the expected loss to each class.

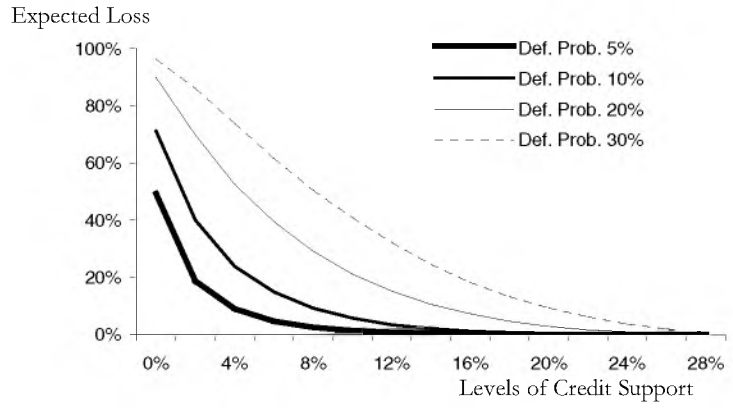
What Happens When Credit Quality is Varied?

In Figure 11a, we display the expected loss for different levels of credit support when we hold severity and correlation constant at 35% and 30% respectively, but vary the default probability of the loans in the pool. For instance, if the loans have 30% chance of defaulting,

a bond with 10% credit support would have a 40% expected loss. If the loan pool is of higher quality and the default probability is just 5%, a bond with the same credit support would only have a 1% expected loss. As loan quality improves, the overall expected loss to the trust is lowered, and so are the expected losses to all classes.

Alternatively, we can use the simulation to back out the level of credit support required for each class so that the bond will have a certain expected loss. In this analysis, we follow the expected loss values used by Moody's: 0.006% for AAAs, 1.98% for BBBs, and 14.96% for Bs. For each default probability scenario, we compute the credit enhancement levels required for AAA, BBB, and B rated bonds. As shown in Figure 11b, as the loan quality improves, the required credit support falls for all bonds. For instance, the required credit support for AAA drops from 31% to 18% as the conduit loans improve from a 30% default probability to just 5%.

Figure 11a: Improving Loan Quality Lowers Expected Losses to All Classes



* Assumes 35% loss severity, 30% correlation

Figure 11b: Improving Loan Quality Lowers All Credit Support

	Support		
Loan Default Probability Scenario	**AAA**	**BBB**	**B**
30%	31%	23%	16%
20%	29%	18%	11%
10%	23%	11%	5%
5%	18%	6%	2%

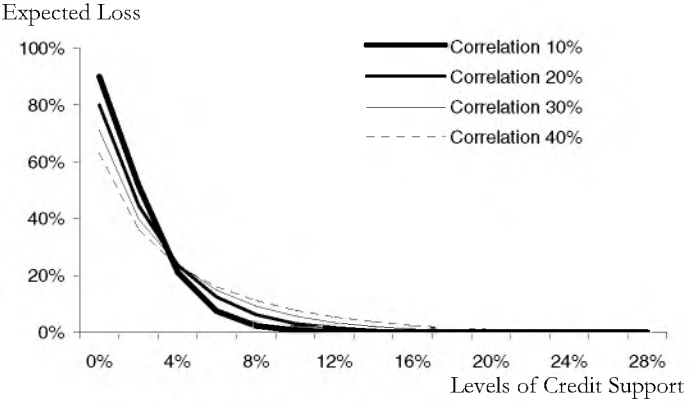
* Expected loss assumptions according to Moody's

How about Varying Diversification?

Next, to demonstrate the effect of diversity, we hold constant the default probability at 10% and the severity at 35%, while varying the asset correlation from 10% to 40%; the greater the correlation, the less diverse the pool. Figure 12a shows the expected loss for different levels of credit support across pools with varying diversity. As the level of diversity changes, the expected loss to the trust remains unchanged, but is distributed differently across classes. The curve gets flatter as the pool gets less diverse, indicating that the senior bonds are expected to suffer higher losses while the equity pieces are better off.

We also computed the credit enhancement levels required for AAA, BBB and B rated bonds for different levels of diversity. The results are highlighted in Figure 12b. The credit support for AAA drops from 28% to 12% as the correlation of the pool is reduced from 40% to a more diversified level of 10%. On the other hand, the credit support for B classes is not very sensitive to the different diversity levels.

Figure 12a: Diversity has Different Impact on Different Parts of the Capital Structure



*Assumes 35% loss severity, 10% default probability

Figure 12b: Credit Support as Pool Diversifies

	Support		
Loan Correlation Scenario	**AAA**	**BBB**	**B**
40%	28%	14%	5%
30%	23%	11%	5%
20%	18%	9%	5%
10%	12%	7%	4%

* Expected loss assumptions according to Moody's

What are Practical Assumptions for Credit and Diversity of Conduit Loans?

To take the analysis further, we need to make assumptions about the credit quality and diversity level of conduit loans. We base our assumptions on historical observations as well as the implicit values used in recently priced transactions, and arrive at the following practical assumptions for conduit pools:

- **Default probability of 10%.** As shown earlier, the rating agencies assign credit support on conduit transactions with the expectation that cumulative defaults will be in the range of 10%. To date, cumulative liquidation rates observed in CMBS transactions have been well below 10%, even for older vintages.
- **Loss severity of 35%.** This is consistent with historical loss severities in CMBS.
- **Asset Correlation of 30%.** This is consistent with asset correlation levels observed in the equity market, and is in line with rating agencies' assumptions.

Under these assumptions, our model estimates required credit enhancement for a conduit transaction to be 23% for AAA, 11% for BBB and 5% for B, which are comparable to recently-priced conduit transactions. We emphasize that adjusting any of these assumptions will alter the numerical results, but will not change the conclusions of our analysis.

Diversity vs. Credit Quality in Fusion Transactions

Extending the Conduit Approach to Fusion

Our next step is to extend the method used for conduit transactions to analyze fusion deals. We construct a sample deal with $1 billion principal balance, consisting of 60% conduit loans and 40% large-loans. The *conduit* sub-pool has the same qualities as in the pure *conduit* case: $5 million loan size, 10% default probability, 35% severity, and 30% correlation. For the large-loan sub-pool, we vary the diversity by changing the number of loans (thus changing the loan size for each loan), and vary the quality by changing the rating (and the expected loss) of the large-loans. Both loss severity and asset correlation are held constant at 35% and 30%, respectively. Our approach to the large-loan pool spans the diversification scale: from a single large-loan of $400 million (40% of the deal) to 80 loans of $5 million each (also worth 40% of the deal). In the latter case, the size of the loans in the "large-loan" sub-pool is equivalent to the *conduit* sub-pool. We evaluate large-loans of increasing credit quality and assign a default probability consistent with Moody's approach to shadow-rated loans. Given these assumptions, similar to the base case, we employ Monte Carlo simulation to find the required credit enhancement level for different classes.

Results

In Figures 13a - c, we evaluate the level of required credit enhancement under various scenarios for AAA, BBB and B classes. The results can be interpreted across two axes: moving horizontally along a curve represents increasing/decreasing diversity, while moving vertically from one curve to another represents increasing/decreasing credit quality. Each individual curve represents the level of credit support as the large-loan pool gets more

diverse for a given shadow rating. The extreme case of 80 large-loans with default probability of 10% is essentially equivalent to the credit quality of the conduit loan pool. This serves as the base case for comparison with *fusion* deals. The main observations are as follows:

- **AAA Class** – As expected, better quality large loans require less credit support. Take the case of 10 large-loans in the transaction: upgrading the average shadow rating of the large-loans from BBB to A reduces required AAA credit enhancement by about 3%. The marginal impact diminishes as large loan credit quality approaches AAA. Diversification can be an even more significant factor for AAAs. If large loan credit quality is held constant, increasing diversity results in lower required credit support, though the incremental effect is minimal once there are more than 5 to 10 large loans. For example, when the large loans are of single A quality, the required AAA credit support drops from 24.2% to 17.5% when loan diversity changes from 1 loan comprising 40% of the deal to 5 loans each comprising 8% of the deal. Increasing the number of large loans to 10 has minimal impact, reducing AAA credit support to 16.8%. This result demonstrates that, even with large-loans, AAAs can achieve maximum diversification benefits rather quickly.
- **BBB Class** – Similar to the results for AAA, better quality large loans result in less credit support for the BBB class as well. Diversification reduces credit enhancement when the large loan sub-pool is shadow-rated BBB. However, if the large loan sub-pool is rated A or better, increasing diversification has little impact on the BBB class.
- **B Class** – Again, improving large loan quality reduces required credit support. However, in most cases, diversification results in ***higher*** credit enhancement for the B class. The incremental effect levels out after 10 loans, which once again demonstrates that the pool is fully diversified with just 10 loans. This effect is less pronounced if the large loan pool has higher credit quality.

Figure 13a: Change in AAA Required Credit Enhancement Levels

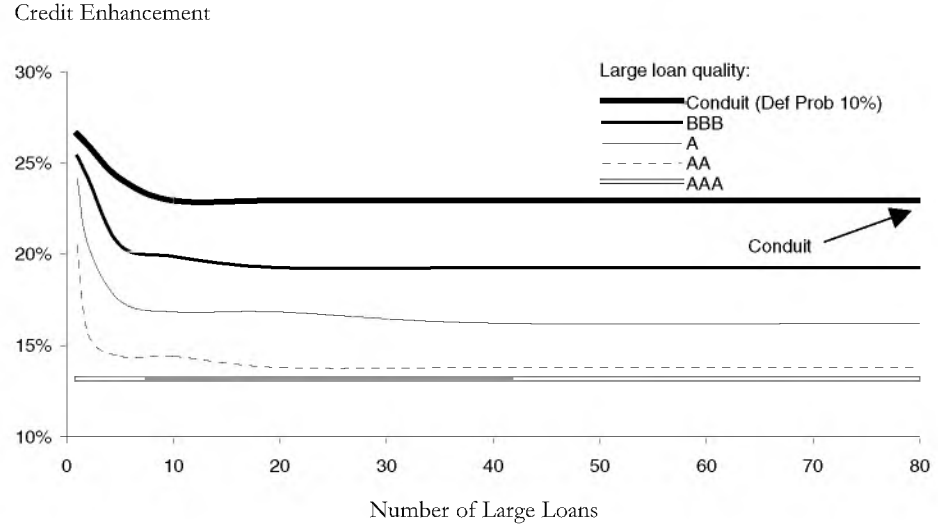


Figure 13b: Change in BBB Required Credit Enhancement Levels

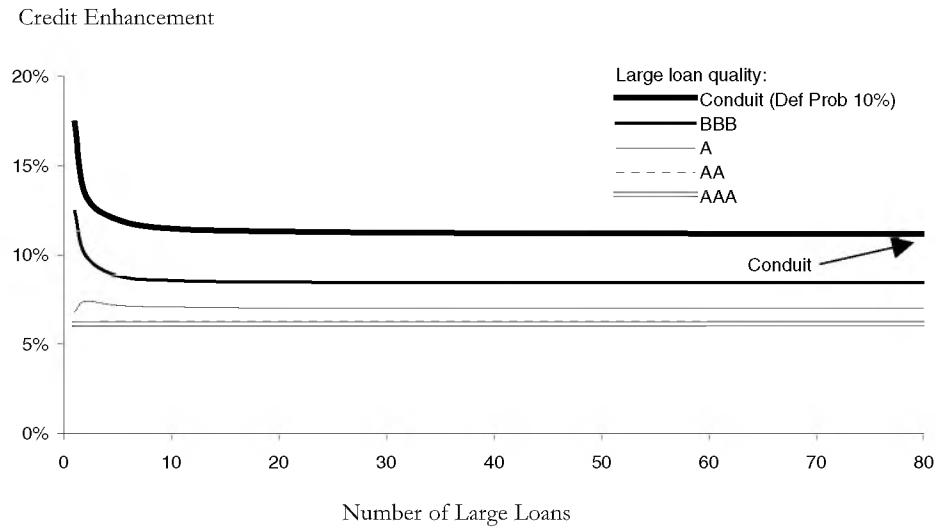
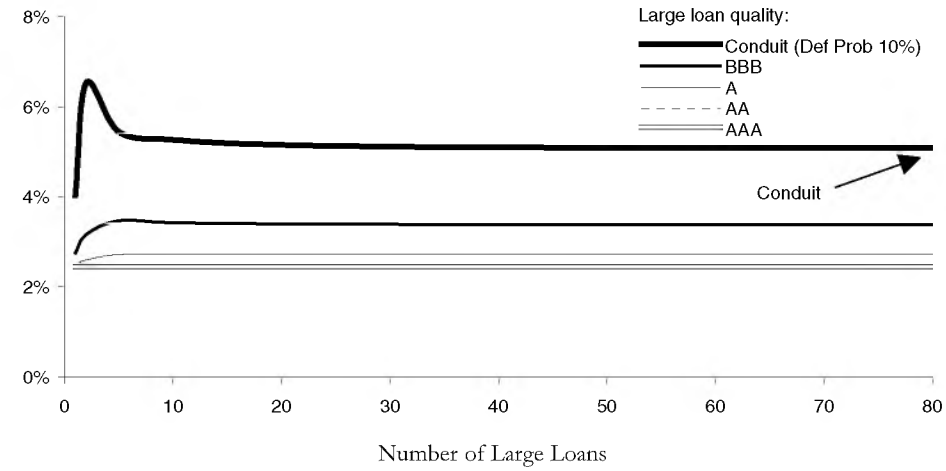


Figure 13c: Change in B Required Credit Enhancement Levels



Note that the B class displays a rather curious pattern in the 10% default probability case: required credit support rises as the number of large loans increases from 1 to 2, and then falls as more large loans are added. We explain this with the help of the following scenario: assume that the B class has 5% credit support and is 4% of the deal in size. This means that $90 million of total losses on the deal will wipe out this class. A 10% default probability with a 35% loss severity on the $600 million conduit pool would generate $21 million in losses. Therefore, the large loans must generate another $69 million in losses for the B class

to be wiped out. In the case of one large loan, this would be accomplished if the large loan defaults; the probability of that is 10%. In the two large loan case, any of the two loans defaulting would wipe out the B class; the probability of that happening is 19%. Hence, the B class is considerably more likely to be wiped out in the case of two large loans, necessitating higher credit enhancement. Adding more large loans effectively reduces the size of each loan; several loans then have to default for the B class to be wiped out. The probability drops materially as does the required credit support as compared with the two large loan case.

Summarizing the Tradeoff of Credit Quality vs. Diversity

Figure 14 highlights some of the key cases that best demonstrate the tradeoff between credit quality and diversity in *fusion* transactions. For comparison, we include the *conduit* case, in which credit enhancement to AAA, BBB and B are 23%, 11% and 5%, respectively.

1. **Two BBB large loans.** In this case, large loan credit quality (BBB) is moderately higher than the conduit pool, but diversification benefits (2 loans, each 20%) are minimal. AAA rated classes structured from this fusion pool would require credit support slightly higher than the conduit case – 24%. Improvement in credit quality is not enough to compensate for the reduction in diversity for the senior bonds, but is beneficial to subordinate classes. Required single-B credit support would fall by almost 2% in this case.
2. **Five BBB large loans.** In the more diverse case, large loan credit quality (BBB) is moderately higher than the conduit pool and diversification benefits (5 loans, 8% each) are helpful. The diversity and credit effect are enough to reduce the credit support for all classes as compared with the conduit case.
3. **Two A large loans.** In this case, large loan credit quality (A) is considerably higher than a conduit pool, but diversification benefits (2 loans, each 20%) are minimal. Despite relatively low diversity, the A credit quality of the large loans manages to improve the credit enhancement for all bonds. The greatest incremental gains are felt in the lowest-rated tranches, which benefit from higher loss variability.
4. **Five A large loans.** In this case, large loan credit quality (A) is considerably higher and diversification benefits (5 loans, 8% each) approach the optimal range for the large loan pool. Credit enhancement is significantly reduced for all classes as compared with the conduit case.

Figure 14: Summary of The Effect of Changing Credit Quality and Diversity Level

Deal Type	Large Loan Rating	Number of Large Loans	Size of Large Loans	AAA	BBB	B
Conduit				23%	11%	5.1%
Fusion 1	BBB	2	200	24%	10%	3.2%
Fusion 2	BBB	5	80	20%	9%	3.5%
Fusion 3	A	2	200	20%	7%	2.5%
Fusion 4	A	5	80	17%	7%	2.7%

Conclusions

Recent developments in the CMBS market point to the on-going incorporation of large loans into conduit transactions. Blending conduit loans with investment-grade large loans to form *fusion* transactions involves some trade-offs between credit quality and diversity. Our analysis shows that improvement in credit quality benefits all classes. Seemingly trivial, this conclusion is important because there is convincing evidence that CMBS deal quality has been improving – conduit loans are more uniform and have better credit characteristics now than in the past; and, at least 20% of loan principal in 2003 deals consists of investment-grade quality large loans.

Second, the benefits of diversification are dependent upon the capital structure. In reducing the variance of losses, diversification helps the senior-most classes but could hurt equity holders. ***Though fusion transactions are decidedly less diverse, diversification benefits can be achieved through a relatively small number of large loans, typically less than 10.***

Thus, the tradeoff: for *fusion* transactions, the improvement in credit quality often outweighs the reduction in diversity. A *fusion* transaction with 5 to 10 investment-grade large loans can effectively lower the credit support compared to a *conduit* deal despite the reduced diversity. Though the potential exposure to a single event is higher, the risk of that event is lower because the expected loss on an investment-grade loan is substantially lower than that of a typical conduit loan. For example, an A rated loan has an expected loss of 0.66% compared with an expected loss of 7.43% for a BB rated loan. In the final analysis, the credit quality of the large loans is crucial in evaluating a fusion transaction. Holding other factors constant, as loan quality improves, fewer loans are needed to achieve full diversification benefits.

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