Credit Products
Criteria Report

Global Rating Criteria for Collateralised Debt Obligations

This report updates that of 1 August 2003

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■ Summary

This report updates the Global Rating Criteria for CDOs published in August 2003. The core components of the methodology remain unchanged, namely:

- multi-step Monte Carlo simulation;
- incorporation of asset-specific correlation assumptions;
- recovery assumptions tiered by rating stress;
- empirically based Fitch CDO Default Matrix;
- revised interest rate stresses;
- explicit reinvestment assumptions; and
- adjustment for Collateral Asset Manager ("CAM") ratings.

Additional enhancements in 2004 include:

- increased granularity in ABS sector classifications;
- revised default back-end timing stresses;
- revised treatment of high-yield corporate collateral;
- use of VECTOR as a portfolio trading tool; and
- clarification of the use of CDO CAM ratings.

CDO performance is directly linked to three factors; the behaviour of the underlying assets, the CDO's structural features and the CDO's asset manager performance. All of these variables are addressed in Fitch's rating criteria through Fitch's Default VECTOR Model [1] ("VECTOR"), policies regarding structural features and adjustments based on Fitch's CDO CAM Ratings. The criteria also factor in the 2000-2002 stressful credit environment, which saw more bond defaults than the cumulative volume of defaults occurring in the 20-year period beginning in 1980 and ending in 1999.

The main quantitative tool implemented in the criteria is VECTOR used in conjunction with the cash flow model. VECTOR allows greater precision and granularity in portfolio risk modelling when evaluating and rating a CDO. It also addresses new structures in the market, such as recent synthetic structures and basket trades. VECTOR uses an annual multi-step Monte Carlo simulation that incorporates default probability, recovery rate assumptions and correlations to produce portfolio and loss distributions.

The criteria also draw on Fitch's comprehensive experience of the performance impact of all types of structural features, capitalising on its in-depth empirical research since the advent of the CDO market.

[1] The Fitch Default VECTOR Model was developed jointly with Gifford Fong Associates, Lafayette, CA

Characteristics of Various CDO Types

Criteria	Characteristics	CDO Type
Asset Type	Bonds	Collateralised Bonds Obligation (CBO)
	Loans	Collateralised Loan Obligation (CLO)
	Entities, Mixed Portfolios	Collateralised Debt Obligation (CDO)
	Structured Finance Securities	CDO of ABS/MBS, CDO of CDO
Motivation	Arbitrage	Arbitrage CDO
	Risk Management	Balance Sheet CDO
	Funding	Cash Flow CDO
Risk Transfer	True Sale	Cash Flow CDO
	Synthetic	Synthetic CDO

Source: Fitch

Asset manager decisions will affect the performance of a CDO, and history has shown that performance across similar portfolios can vary markedly under different managers. To appraise an asset manager's performance, Fitch utilises its CDO CAM ratings, the results of which will be integrated into the default and loss determination under the CDO analysis.

This report focuses on the rating analysis behind all types of CDO transactions with the exception of market value CDOs, trust preferred CDOs and private equity and hedge fund collateralised fund obligations. It outlines the theory behind Fitch's approach to modelling the risk of defaults and losses in a portfolio of debt obligations, describes the mechanics and the application of VECTOR, and outlines the stress tests and modelling assumptions applied to a structure and the cash flows of rated CDO tranches. This criteria report is supplemented by other CDO research published by Fitch, referenced at the end of this report.

■ Types of CDOs

CDOs can be categorised using three criteria: asset type, motivation and form of risk transfer. The specific combination of these criteria will dictate a CDO transaction's name, although, despite the variety of deal types, all CDOs have one thing in common: they securitise the credit risk of debt obligations in one way or another.

CDO Deal Types

CDOs encompass collateralised loan obligations ("CLOs"), in which the assets being securitised are primarily loans, and collateralised bond obligations ("CBOs"), in which the portfolio is primarily made up of bonds. Both deal types can be classified as CDOs – the term also used for portfolios combining both bonds and loans, portfolios of structured finance products, such as asset-backed securities ("ABS"), mortgage-backed securities ("MBS") or other CDOs, and for transactions where the underlying portfolio does not reference specific debt obligations but rather entities, e.g. corporates or financial institutions.

Depending on the motivation behind a CDO transaction, deals can be split into arbitrage and balance sheet. Balance sheet CDOs are primarily used by financial institutions to transfer credit risk into the capital markets to manage their credit exposures and/or improve returns on economic or regulatory capital. This also implies an element of arbitrage, which is less apparent in balance sheet CDOs than arbitrage CDOs. The motivation for an arbitrage CDO is to realise a profit on the margin between the weighted average return received on a portfolio of debt obligations and the cost of hedging the risk in the capital markets via the issuance of the CDO notes or swaps. Individual judgement of the risk embedded in the securitised portfolio and ability to outperform the market are both the driver and impact of the arbitrage CDO market.

A third criterion to differentiate CDOs is the way the credit risk is transferred into the capital markets, i.e. a true sale, where the CDO issuer purchases the credit risk debt obligations and becomes their legal owner, or a synthetic risk transfer, usually using a credit default or a total return swap (CDS or TRS, respectively).

In synthetic CDOs, debt obligations are referenced for loss determination without being purchased by the CDO issuer. Since it does not receive any payments but rather the premium on the synthetic instrument transferring the credit risk, the proceeds from the issuance of the CDOs are invested in low-risk collateral, which facilitates the coverage of the credit risk borne by the issuer and the redemption of the issued notes upon maturity.

CDO Asset Types

CDOs are asset-backed securities where the underlying portfolio can include either various types of debt obligations or focus solely on one class of debt. An in-depth analysis of the debt obligations in a CDO portfolio is essential, since, depending on the debt type, one can expect, *inter alia*, different

recovery rates on the obligations upon their default, different characteristics in terms of recovery lag, or different prepayment profiles.

Ultimately, all assets in a CDO portfolio can be classified as bonds or loans, although both debt types appear in various forms with unique characteristics. Bonds are fixed income, tradable and relatively liquid debt obligations issued by an entity seeking external capital in the debt markets, be it a sovereign, corporate or financial institution. Debt is also often raised via specific funding entities, e.g. special purpose vehicles ("SPVs"), in structured finance transactions. Bonds are fungible instruments and, depending on the credit rating of the issuer, are classified as either investment grade ("IG") or high yield ("HY"). In addition to the specific structured finance instrument classifications, such as ABS, MBS and CDOs (together referred to as ABS), IG and HY can be used to describe the nature of the underlying portfolio of bonds securitised in a CDO transaction.

Bonds, whether IG or HY, very rarely benefit from an assignment of dedicated collateral or asset security; rather, they are generally unsecured obligations of the issuer. However, the structural characteristics of individual bond issues can create subordination and seniority between different instruments issued by a single borrower or borrowing group. While in ABS transactions this can be expressed in the sequential allocation of incoming cash flows to pay down senior tranches ahead of junior tranches, for all other bonds with a senior-junior relationship, the subordination becomes relevant in the event of an issuer default and attempted recovery by the bondholders. Structural subordination is less of an issue in the IG bond sector as IG bonds will typically be structured on a *pari passu* basis alongside other debt, including bank loans, taken on by an issuing entity.

Loans are less fungible instruments than bonds since they are generally less liquid and, therefore, less tradable, and will usually be held by a smaller group of investors (lenders) than bonds. Although investment in a loan may be sold via a primary syndication or in the secondary market, the relationship between debtor and creditor on a bank loan instrument is generally much stronger than is the case with a bond. However, this distinction is likely to become increasingly blurred as bank lenders become more aware of the need to manage their capital resources and credit risk exposure more efficiently and to prepare for Basel II requirements, all of which should lead to greater liquidity and trading activity in the global bank loan market.

The characteristics of bank loans will vary depending on whether the borrower is an IG or a sub-IG issuer, reflecting the differing credit risk profiles of these issuers. IG bank loans will usually be unsecured debt obligations ranking *pari passu* with all other obligations and indebtedness, including any bonds issued by the borrower. In the case of a default by the issuer, the unsecured bank lenders would claim against the borrower on a *pari passu* basis with the bondholders.

Bank loans usually securitised in CDOs tend to be granted to sub-IG borrowers and will almost always need to provide the bank lenders with security over some or, more usually, substantially all of their assets. In this scenario, a borrower default can lead to the senior secured bank lenders taking action to enforce their security, either on an asset break-up basis or via a sale of the company as a going concern. Theoretically, enforcement proceeds are used first to pay all outstanding loan interest and principal to the secured lenders, with any remainder being available for distribution to unsecured creditors. However, while this principle is practiced in the US and certain European jurisdictions (most notably the UK), a number of European insolvency regimes have adopted an approach that allows junior creditors to achieve a certain level of recovery even if senior secured lenders are not repaid in full.

The capital structure of leveraged buy-out ("LBO") transactions or other sub-IG issuers can comprise a combination of various debt instruments, issued by a single borrower group with differing levels of seniority as follows: senior secured loans; junior secured loans (mezzanine debt); senior unsecured loans or bonds; subordinated loans or bonds.

IG Issuer

Assets	Liabilities
Assets	Senior Bonds/Loans (Unsecured) Equity

Source: Fitch

Sub-IG Issuer

Assets	Liabilities
Assets	Senior Secured Loan Subordinated Debt (Mezzanine or HY Bonds) Equity

Source: Fitch

Highly leveraged issuers are, by nature, usually of sub-IG quality. However, the qualitative and structural considerations that form an integral part of

Fitch's analysis of any issuer or debt issue mean that degree of financial leverage is only one factor to be considered when calculating whether an issuer falls into the IG or sub-IG arena. Fitch analysts always carry out an in-depth analysis of the underlying debt instruments in every CDO rated by the agency to identify the seniority or subordination of the individual assets and their respective expected recovery rates.

ABS assets, although fungible instruments, are generally less liquid than bonds. However, ABS benefit from the fact they are issued by SPVs, the assets of which are ring-fenced for the holders of the ABS. Hence, ABS investors have access to dedicated collateral in the case of a default of the ABS obligation, and the proceeds from the collateral are allocated sequentially from the senior notes to the junior notes and the equity.

In synthetic CDOs, the analysis of the underlying obligations in the portfolio is made more complex by the fact that losses can be determined on a variety of the debt obligations of the referenced entity. Depending on the CDO structure, all of the above-mentioned debt types can qualify as reference obligations. When modelling recovery rates in synthetic CDOs, Fitch assumes the instrument of a referenced obligor with the lowest expected recovery rate will default. Please see "*Loss Severity and Recovery Rates*" for Fitch's recovery rate assumptions.

■ CDO Rating Process and Rating Definition

The rating process begins when Fitch receives a request from an arranger or sponsoring institution of a CDO. The first step is usually a review of the asset manager, originator or servicer (see "*Asset Manager and Originator*" below) to determine the motivation behind the transaction and their ability to manage and service the portfolio appropriately.

The rating process continues with the determination of the portfolio's quality and the probability of defaults in the portfolio. Depending on whether the transaction's portfolio is static or revolving and whether it is already ramped up or not, Fitch will assess default and recovery levels either on an actual basis or based on the eligibility and portfolio criteria set out in the indenture. Next, it will review the proposed structure and its impact on the transaction cash flows. Various cash flow scenarios incorporating interest rate and currency stresses simulate different default patterns to determine whether subordination levels and priority of cash flows are sufficient to meet the desired ratings.

Legal documentation will also be reviewed to ensure that the structure is clearly defined and the investors' interests properly represented. After the transaction has closed, Fitch will monitor the CDO's performance and adherence to guidelines through ongoing surveillance.

Rating Definition

CDOs are typically rated with multiple tranches of liabilities of varying credit quality and seniority. Any rating assigned by Fitch to such liabilities addresses the probability of a particular tranche performing in accordance with the terms of the notes. In the investment grade categories, the rating gives particular weight to the tranche's ability to pay timely interest and ultimate principal. In the sub-investment grade categories, the terms of the notes may allow for interest to be deferred and paid in kind ("PIK"), thus the rating addresses the ability of the notes to repay principal and ultimate interest by final maturity. Additionally in some other cases, the rating may address only the ultimate repayment of the investor's investment or a minimum internal rate of return ("IRR"), which may come from a combination of principal and interest. Fitch will give a clear description of the type of rating assigned to a particular tranche in its presale and new issue reports.

■ Default Probability in CDO Portfolios

The centrepiece of Fitch's CDO rating methodology is the Fitch Default VECTOR model, a portfolio analytics tool that uses Monte Carlo simulations incorporating default probability, recovery rate assumptions and asset correlation to calculate potential portfolio default and loss distributions.

Using a multi-step process, at every step in the simulation the asset portfolio is updated by removing defaulted assets, updating asset histories and recording default events and recoveries following default. VECTOR also incorporates sector-specific correlations calibrated to the term of the Monte Carlo simulation, while intra-industry correlation is evaluated by a factor analysis of industry and idiosyncratic exposures.

The first step in the analysis of credit risk in a CDO portfolio concentrates on the quality of both the individual assets and the overall portfolio.

Determination of Asset Quality in CDO Portfolios

Fitch's assessment of default probability for a reference portfolio is based on the credit quality of the reference assets, usually measured by their ratings. Since underlying assets in a CDO are typically rated by Fitch, this rating will be the

Fitch CDO Default Matrix
(Cumulative Default Probabilities in %)

	Years									
Rating	1	2	3	4	5	6	7	8	9	10
AAA	0.00	0.00	0.02	0.03	0.05	0.08	0.10	0.13	0.16	0.19
AA+	0.00	0.02	0.05	0.13	0.19	0.26	0.33	0.40	0.48	0.57
AA	0.01	0.02	0.07	0.16	0.26	0.38	0.49	0.62	0.75	0.89
AA-	0.01	0.05	0.13	0.23	0.36	0.51	0.66	0.82	0.98	1.15
A+	0.03	0.11	0.22	0.37	0.56	0.76	0.98	1.20	1.43	1.65
A	0.04	0.13	0.26	0.43	0.62	0.84	1.07	1.32	1.58	1.85
A-	0.08	0.23	0.42	0.66	0.92	1.20	1.49	1.80	2.12	2.44
BBB+	0.12	0.32	0.57	0.87	1.20	1.55	1.93	2.32	2.72	3.13
BBB	0.21	0.54	0.91	1.32	1.89	2.30	2.67	2.97	3.34	3.74
BBB-	0.42	1.07	1.87	2.74	3.63	4.48	5.27	6.00	6.66	7.26
BB+	0.72	1.89	3.20	4.52	5.74	6.85	7.84	8.75	9.47	10.18
BB	1.46	3.08	4.79	6.51	8.11	9.48	10.69	11.78	12.71	13.53
BB-	2.80	5.19	7.48	10.63	12.50	14.06	15.36	16.44	17.46	18.46
B+	4.15	8.81	12.54	15.02	17.09	18.86	20.05	21.51	22.22	22.84
B	5.71	11.75	16.29	19.12	21.36	23.36	24.51	26.26	26.98	27.67
B-	10.55	16.81	20.89	24.60	27.08	29.20	29.99	32.12	33.50	34.98
CCC+	15.93	22.52	26.14	30.86	33.64	35.90	37.38	38.87	41.00	43.36
CCC	17.83	25.20	29.25	34.53	37.64	40.16	41.82	43.50	45.87	48.52

Source: Fitch

primary reference for portfolio analysis. However, if no Fitch rating is available, the agency will also look at public ratings assigned by another Nationally Recognised Statistical Rating Organisation ("NRSRO").

When Fitch looks at public ratings from another NRSRO, it accepts the fact that, for the overwhelming majority of obligors rated by more than one rating agency, the ratings will be within one sub-category. Therefore, rather than introducing formulaic, across-the-board treatments which produce imprecise and costly results, Fitch applies a credit-focused approach combined with a fair treatment of ratings assigned by other rating agencies.

For investment grade corporates and all structured finance assets not rated by Fitch but publicly rated by two other NRSROs, Fitch will use the lower of the Fitch-equivalent ratings from the other agencies. For high yield bonds and leveraged loans not rated by Fitch but publicly rated by two other NRSROs, Fitch will use the average of the Fitch-equivalent ratings from the other agencies. However, should such a credit be publicly split-rated between IG and sub-IG, Fitch will use the lower of the two ratings. For all corporate ratings, the equivalent senior unsecured issuer Long-term credit rating will be used. If an asset is publicly rated by only one other NRSRO, Fitch will use this rating. However, to ensure maximum diligence in the analysis of a securitised portfolio, the agency may adjust the rating used when there is an indication that Fitch's credit opinion may differ from that derived by the above-mentioned rule.

To capture adverse selection and moral hazard risks, Fitch will check whether a particular name is on Rating Watch Negative (or similar indicators by other NRSROs) and will reduce the rating, by one sub-category, for the purpose of a CDO evaluation. The agency may also take into account market information, e.g. credit default spreads and bond prices.

For structured finance securities, Fitch has established its "Challenged Deal List". This list comprises ABS transactions that Fitch assessed but did not rate. Such ABS are reported in the Challenged Deal List with the estimated rating Fitch would have assigned had it rated the transaction publicly, which can be several sub-categories below the rating derived using the above-mentioned rule. In certain instances, for Fitch to evaluate selected structured finance securities not rated by Fitch, the asset manager may be requested to provide the agency with the offering memoranda of the respective securities and, on an ongoing basis, with performance reports.

For CDOs of small and medium-sized enterprises where it is likely that not all the reference entities are publicly rated, Fitch may assess portfolio quality using a mapping to the originator's internal rating system (see "*European SME CDOs: An Investor's Guide to Analysis and Performance*" dated 2 October 2001, and "*Rating Criteria for US Middle Market Collateralized Loan Obligations*", dated 25 June 2002 at www.fitchratings.com). Alternatively, the agency may apply corporate rating models like Fitch Risk Management's automated corporate rating tool, CRS, which estimates Long-term credit ratings

based on quantitative and qualitative information on the obligor.

Except for structured finance securities, the relevant rating indicating an asset's credit risk is always the issuer's Long-term rating. In most cases, this is equal to the rating assigned to the debt instrument. For instruments such as leveraged loans or subordinated bonds, however, the instrument rating may have been notched up or down in recognition of its benefiting from security or its subordinated position respectively. Such structural elements are reflected in recovery assumptions made by Fitch.

Weighted Average Portfolio Quality and Fitch CDO Default Matrix

Fitch has developed the Fitch CDO Default Matrix ("Default Matrix") specifically for use in its CDO rating model. The Default Matrix is based on global historical default rates modified to reflect the diversity imposed by CDO collateral policies. The CDO Default Matrix is utilised in the VECTOR model to define default probability for each collateral asset, and secondly, to define the distribution percentile corresponding to the respective CDO tranche's rating.

Fitch will assign a default probability to each asset, depending on its term and rating, as per the Default Matrix. The Default Matrix can be used to calculate the weighted average rating factor ("WARF") of any CDO portfolio. Although Fitch utilises asset by asset rating information in its default and recovery analysis, the WARF represents a useful indicator of the portfolio's average credit risk and may help in comparing performance across different portfolios.

Fitch Rating Factors

Rating	Factors
AAA	0.19
AA+	0.57
AA	0.89
AA-	1.15
A+	1.65
A	1.85
A-	2.44
BBB+	3.13
BBB	3.74
BBB-	7.26
BB+	10.18
BB	13.53
BB-	18.46
B+	22.84
B	27.67
B-	34.98
CCC+	43.36
CCC	48.52
CC	77.00
C	95.00
DDD – D	100.00

Source: Fitch

A portfolio's WARF is calculated by dividing the sum-product of the assets' outstanding amounts times their Fitch Rating Factors (see below) by the total notional portfolio amount. The factors represent the 10-year default probabilities for the respective weightings.

Servicer Limits

In addition to the portfolio default and recovery analysis done in VECTOR, Fitch has developed guidelines for limitations on a CDO's exposure to individual servicers of the MBS and ABS purchased by the collateral manager. In general, a CDO may not have more than 7.5% of the collateral pool invested in securities that are serviced by any one servicer rated below 'S2' or with a Long-term financial rating lower than 'A–'. Fitch's servicer concentration guidelines are shown below. The agency will look to the servicer rating first, then to the Long-term issuer rating.

In some cases, Fitch has been comfortable with exceptions to these guidelines, particularly in situations where the underlying loans are originated by a third party or the loans are special serviced with an underlying primary servicer. This mitigates the exposure to the "crash" of a particular origination shop or vintage. This is frequently the case in CMBS concentrated CDOs and some RMBS concentrated CDOs.

Fitch rates residential and commercial mortgage primary, master, and special servicers on a scale of 'S1' to 'S5', with 'S1' being the highest rating. Fitch servicer ratings were established to provide investors and other market participants with a clear indication of servicers' capabilities based on a quantitative benchmark assessment.

Servicer Concentration Limits

Long-Term Financial Rating/Servicer Rating	Portfolio Limit (%)
Below A- or S2	7.50
A- or S2	10.00
AA- or S1	15.00

Source: Fitch

Default Probability Adjustments

Fitch's study of historical default rates, which has been used to derive the CDO Default Matrix, captures instances of distressed bond exchanges, failure to pay and bankruptcy of corporate debtors. Fitch is aware that the application of hypothetical default rates derived under such default definitions may not always be appropriate for all types of CDO transactions, specifically synthetic CDOs and CDOs of ABS.

In synthetic corporate CDOs, credit events usually conform to the 1999 International Swaps and Derivatives Association ("ISDA") credit derivative definitions and supplemental amendments. New CDOs will, however, begin to incorporate the new 2003 definitions (see "*Fitch Examines Effect of 2003 Credit Derivatives Definitions*", dated 6 March 2003, available at www.fitchratings.com). Market convention generally defines credit events as:

- Bankruptcy
- Failure to Pay
- Restructuring
- Obligation Acceleration
- Moratorium

Fitch is concerned that the ISDA restructuring and obligation acceleration credit events could be triggered on occasions where the relevant entity continues to perform, exposing the protection seller to a loss that does not reflect loss upon default but rather market value loss on a still-performing asset. The risk of a soft credit event being triggered is considered greater for lower-rated assets, whose debt will typically have more covenants that may be breached, triggering a credit event. Therefore, Fitch reserves the right to apply an adjustment in its default assumptions where such events are included. The lower the rating of the asset, the greater the adjustment factor may be.

While Fitch has not developed a default curve for ABS and MBS due to the relatively short default history of these sectors, the agency expects such transactions to have on average lower default rates than corporate issuers. With very few ABS or MBS defaults reported, Fitch's structured finance and corporate rating transition studies support the view that negative structured finance rating migration is lower than that in corporate ratings (see *Global Structured Finance Ratings Performance: First Half 2004 Review*, dated 19 July 2004 and "*Fitch Ratings Corporate Finance 2003 Transition and Default Study*", dated 19 July 2004, both available at www.fitchratings.com).

As a result, the default rates shown in the Default Matrix may be adjusted by the agency for certain structured finance asset classes for which the migration experience has been demonstrably superior to corporate ratings. Any default rate adjustment can be made directly in the VECTOR model in the "Default Rate Adjustment" column on the "Portfolio Definition" worksheet.

■ Loss Severity and Recovery Rate

Recovery rates for defaulted assets in a CDO primarily depend on the characteristics of such assets, expressed by the position of the defaulted debt in the debtor's capital structure and the presence or not of any security assigned to it as well as the jurisdiction of the defaulted debtor. However, analysis of empirical data has shown that recovery rates are not only a function of these idiosyncratic or debtor-related factors, but are also influenced by the systemic effect whereby recovery rates decline as defaults increase. This is intuitively sound and easy to understand, since, in a stressful economic environment there are fewer buyers willing to buy a defaulted debtor's assets or acquire an entire company, including its debt, as a going concern. In recognition of this, Fitch has introduced the concept of tiered recovery rate assumptions for increased stress scenarios. While the 'B' stress is roughly anchored at base historical recovery levels, recovery rates for all higher rating categories are adjusted by a factor of between net 20% and net 64% with an adjustment of up to 100%, setting the recovery rate at 0% for sub-investment grade ABS assets in a 'AAA' stress scenario. All current global recovery rates are listed on the "VECTOR Inputs" worksheet of the VECTOR model.

Asset Type, Jurisdiction and Recovery Rate

Fitch's Credit Products teams in Europe and the US have conducted research on the performance of distressed debt using the agency's own empirical data and information provided by recognised institutions like Altman/NYU and Loan Pricing Corporation.

US Assets: For the US, comprehensive empirical data was available for most of the debt types commonly securitised in a CDO. Following the asset type classification explained in "CDO Asset Types", Fitch found average historical recovery rates as shown in the table next page.

Average Empirical Recovery Rates for the US (%)

Senior Secured Loans	65 – 75
Senior Unsecured Debt	40 – 50
Subordinated Debt	20 – 35

Note: these recovery rates are valid as of the publication date of this report. Recovery rate assumptions may change over time. The current recovery rate assumptions will always be available in the latest VECTOR model, available at www.fitchresearch.com.
For senior secured bonds, Fitch will apply a senior unsecured recovery rate.
Source: Fitch

Second Lien Loans: A relatively new addition to the CLO world is that of second lien loans. In the US, a second lien loan is senior to all other subordinated indebtedness of an obligor but is subordinated to at least one other class of obligations with respect to priority of payment. With regard to the final

payment of debt, it is due and payable only after all other senior and *pari passu* obligations of the related obligor are paid in full. As a result, US second lien loans should generally have recoveries in between those of senior secured loans and senior unsecured debt. Similarly, in Europe, second lien loans are subordinated to senior secured debt but rank senior to the traditional junior debt piece, which will normally take the form of a mezzanine facility or a high yield bond. For CDO transactions investing in European second lien instruments, Fitch will use the junior secured recovery rate for the appropriate jurisdiction.

European Assets: In Europe there is a lack of statistical default and recovery rate data for the various debt instruments in each of the different jurisdictions. The only European data comprehensive enough to calculate empirically based recovery rates relates to UK secured loans, which, on average, achieved a recovery rate of 76.5% (see "*Secured Loan Recovery Rate Study – The UK Experience*", dated 29 February 2000). To address this lack of information, Fitch completed studies of four of the key European insolvency regimes (France, Germany, Spain and the UK) and compared them with the US (see "*Regimes, Recoveries and Loan ratings: The Importance of Insolvency Legislation*", dated 11 October 1999 and "*Rating Spanish Loans*", dated 1 June 2000).

However, since the time of these studies, a number of European jurisdictions have implemented changes to their insolvency regimes. Accordingly, Fitch is in the process of a new review to assess the impact of these changes and to expand upon the number of jurisdictions examined.

To conclude, while there have been a number of defaults in Europe over the last few years, available data does not allow statistically compelling recovery calculations outside the debt types and jurisdictions mentioned above. Therefore, Fitch has used these studies to determine conservative base case recovery rate assumptions on various debt instruments across European territories. The table below gives the recovery rate assumptions for France, Germany, Spain and the UK in 'AAA' and 'B' stress scenarios.

Structured Finance Assets: For structured finance, recovery rates for ABS obligations depend on a security's priority within the capital structure of the issuer, the credit rating of the respective tranche and the tranche size relative to its own capital structure. Fitch's rating of an ABS instrument addresses its likelihood of default but does not address loss in the event of default. This is because, typically, the default of a lower-rated ABS tranche may not necessarily lead to a default of a higher-rated tranche. Furthermore, a loss suffered by a lower-rated tranche may alter over time, even while more senior tranches continue to perform. In general, the "thinner" a tranche in relation to the total amount of the securitisation, the greater the risk of high loss severity in the event of a default of that specific tranche.

Fitch takes this into account by applying lower recovery rate assumptions to mezzanine and junior tranches of an ABS than senior tranches, and by distinguishing recovery rate assumptions according to the size of a tranche. Tranches equating to less than 10% of their initial capital structure will receive a lower recovery rate assumption than those greater than 10%. In addition to the tranche factors outlined above, the asset class and characteristics of the underlying portfolio may also be taken into account. Fitch's current recovery rate assumptions are outlined in the "VECTOR Inputs" sheet in the VECTOR model. However, Fitch may adjust ABS recovery rates higher or lower to recognise pool-specific characteristics. Higher adjustments may most commonly be made for pools concentrated in 'AAA' and 'AA' collateral.

Loss Determination

In a cash flow CDO, recoveries are always achieved by either selling the defaulted asset or going through the work-out process. In a synthetic CDO, losses and recoveries are determined by either cash or physical

Corporate Debt Recovery Rate Assumptions

	IG Companies				Sub-IG Companies							
(%)	Unsecured		Subordinated		Senior Secured		Junior Secured		Senior Unsecured		Subordinated	
Stress	AAA	B	AAA	B	AAA	B	AAA	B	AAA	B	AAA	B
US	44	55	24	30	56	70	24	30	36	45	24	30
France	28	35	20	25	32	40	24	30	20	25	8	10
Germany	28	35	20	25	44	55	32	40	17.5	22.5	4	5
Spain	28	25	20	25	32	40	24	30	20	25	4	5
UK	32	40	24	30	60	75	40	50	14.4	17.5	0	0

Note: These recovery rates are valid as of the publication date of this report. Recovery rate assumptions may change over time. The current recovery rate assumptions will always be available in the latest VECTOR model, available at www.fitchresearch.com.
For senior secured bonds, Fitch will apply a senior unsecured recovery rate.
Source: Fitch

settlement. Under a cash settlement, a protection payment is based on the difference between the par value of an obligation selected for valuation and its post-credit-event market value determined in a bidding process, the equivalent of selling a defaulted asset in a cash flow CDO. A variation of this method is used in synthetic balance sheet CDOs, where cash settlement takes place after determination of the write-off amount by the originator. Under physical settlement, the protection buyer is paid the par amount of the defaulted obligation and must deliver such an obligation to the CDO issuer. Depending on whether the CDO then sells the obligation or holds on to it until the work-out process has been finalised, it too is economically equivalent to either selling the asset or going through the work-out process in a cash flow CDO.

Recovery Rate Adjustments

Fitch's standard recovery rate assumptions are set out in VECTOR's "VECTOR inputs" worksheet. However, due to the specific characteristics of every transaction, a Fitch Rating Committee may decide to give credit or to haircut the standard recovery rate assumptions, which can be easily incorporated in the analysis by using the "Recovery Rate Adjustment" column in the "Portfolio Definition" worksheet.

For instance, in synthetic CDOs, the sponsoring institution or protection buyer may have considerable influence over the timing and amount of loss since they are often in a position to determine the call of the credit event and to participate in the bidding process. Furthermore, following a credit event it is the protection buyer who chooses which particular obligation of the failed reference entity should be subject to the valuation process (i.e. the "cheapest to deliver" option). In empirical studies, Fitch has found that this may result in lower average recovery rates (see "*Credit Events in Global Synthetic CDOs: Year-End 2003 Update*" dated 11 June 2004, available at www.fitchratings.com). Consequently, for these structures, Fitch reserves the right to adjust its recovery rate assumptions on a case by case basis as necessary. Fitch also applies a 5% haircut to recovery rates of synthetic transactions where convertible bonds can be a deliverable obligation.

In cash flow CDOs, where the manager usually has reasonable flexibility to decide whether to sell or hold on to a defaulted obligation, the option taken may cause the recovery rate achieved to differ from the market's average recovery rate. Fitch may reflect the manager's recovery abilities as expressed in the Fitch CDO CAM Rating (see "*CDO Collateral Asset Manager Rating*" below).

■ VECTOR

VECTOR is Fitch's main quantitative tool to evaluate the default risk of credit portfolios in CDO transactions. The model can be downloaded by subscribers from the agency's website at www.fitchresearch.com. The model will be accompanied by an installation wizard as well as a comprehensive manual.

VECTOR Methodology

VECTOR is a multi-period Monte Carlo simulation model which simulates the default behaviour of individual assets for each year of the transaction's life. Monte Carlo simulation is widely used in finance and allows for the modelling of the distribution of portfolio defaults and losses, taking into account the default probability and recovery rate as well as the correlation between assets in a portfolio. The model can be used for portfolios of corporate assets as well as portfolios of ABS assets.

VECTOR is based on a structural form methodology (see Appendix 1 "*Structural Form Model and Monte Carlo Simulation*"), which holds that a firm defaults when the value of its assets falls below the value of its liabilities (or its default threshold). The model simulates correlated asset values for each obligor and each period, which are compared to the default threshold derived from the rating and its corresponding default probability in the Default Matrix (see "*Default Probabilities in CDO Portfolios*" above).

VECTOR applies an annual multi-step process. At every annual step an asset portfolio is updated by removing defaulted assets and recording amounts and recoveries upon default. VECTOR simulates the asset values for each year of a transaction, allowing the modelling of time-varying inputs such as correlation and default rates, and incorporating amortisation characteristics for every individual portfolio.

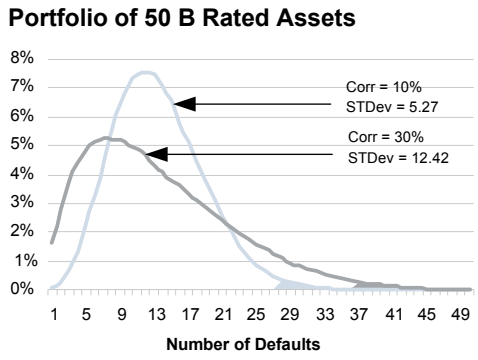
For a more detailed description of the mathematical functions of VECTOR, please see "*The Fitch Default VECTOR Model User Manual*", available at www.fitchresearch.com.

Correlation Between Assets

One of the key components of VECTOR is the explicit incorporation of the correlation between individual assets in a CDO. As mentioned above, the

Impact of Correlation on Portfolio Defaults

The following chart shows the impact of correlation on the portfolio default distribution.



Increasing the correlation changes the distribution pattern, leading to more frequent extreme observations at either end of the distribution, although the mean of the distribution remains unchanged. Both the standard deviation and upper percentile increase significantly as a result of greater correlation. In the extreme case of 100% correlation (meaning that all assets are from the same issuer) either all or none of the assets in a portfolio would be expected to default. As a result, correlation can be both positive or negative, depending on which part of the capital structure is concerned. For the holder of the first loss piece, the higher the correlation the better. Senior investors, on the other hand, prefer low correlation to reduce the probability of large default numbers.

structural form methodology applied in VECTOR models the asset value of individual obligors. Therefore the model requires asset correlation as an input, which measures the degree by which the asset values between two obligors move together across time. Asset correlation is different from default correlation, which measures the relationship between events of default for any two assets (see "*Default Correlation and its Effect on Portfolios of Credit Risk*", dated 17 February 2004, available at www.fitchratings.com).

Correlation Between Corporates

Measuring asset correlation between corporates directly is not possible since historical asset value time series are generally not readily available. Therefore, Fitch used equity return correlation as a proxy for asset correlation and conducted a factor analysis (see Appendix 2: "*Empirically Derived Asset Correlation by Industry*"). Fitch analysed all the companies in the Dow Jones global universe of 6,100 companies, and grouped them into the 25 Fitch industry classes, as shown above, and the 34 countries in which the companies are based. For the most current Fitch correlation matrix, please see the latest version of the VECTOR model on Fitch's website at www.fitchratings.com.

Fitch Industry Classes for Correlation

- Aerospace & Defence
- Automobiles
- Banking & Finance
- Broadcasting/Media/Cable
- Building & Materials
- Business Services
- Chemicals
- Computers & Electronics
- Consumer Products
- Energy
- Food, Beverage & Tobacco
- Gaming, Leisure & Entertainment
- Health Care & Pharmaceuticals
- Industrial/Manufacturing
- Lodging & Restaurants
- Metals & Mining
- Packaging & Containers
- Paper & Forest Products
- Real Estate
- Retail (General)
- Supermarkets & Drugstores
- Telecommunications
- Textiles & Furniture
- Transportation
- Utilities

Correlation Between Structured Finance Products

Due to the lack of structured finance default data, correlation assumptions between structured finance products were established using Fitch's expertise and knowledge base across structured finance sectors. Structured finance securities are typically built on diverse asset portfolios, which are much less exposed to idiosyncratic or event risk. Portfolio theory shows that the lower the idiosyncratic risk inherent in assets, the higher the correlation between such assets. The level of diversity between structured finance products depends on the number of assets in the portfolio, their regional and industry distribution and their level of cross holdings.

Fitch has identified 21 regions and six main asset sectors for the calculation of correlation between structured finance products. For US assets,

Fitch Structured Finance Regions for Correlation

- USA
- Canada
- Central America
- South America
- Germany, Austria, Switzerland
- France, Belgium, Luxembourg
- Netherlands
- Italy
- Greece
- Spain
- Portugal
- Scandinavia
- UK & Ireland
- Eastern Europe
- South Africa
- Australia
- New Zealand
- Japan
- China
- Hong Kong
- Asia Other

correlation is calculated between a further 45 asset sub-sectors. For non-US regions, which lack the depth and breadth of the established structured finance markets of the US, asset sub-sectors may vary.

The agency also recognises that, due to high regional concentration in structured finance products, correlation between similar ABS in the same region is higher than between ABS from different regions. Fitch's correlation assumptions for structured finance assets generally conform to the rules set out below. However, Fitch may adjust ABS correlations higher or lower to recognise pool/asset-specific characteristics.

- Correlation within ABS is higher compared to corporates due to the increased systematic risk.
- Correlation between ABS sectors is lower than within the same ABS sector.

The correlation matrix for all corporate and structured finance sectors is shown on the "VECTOR Inputs" worksheet in the VECTOR model.

VECTOR Outputs

VECTOR is not a cash flow model and does not take into account structural features such as waterfalls or excess spread. The VECTOR outputs reflect the credit quality of the portfolio underlying each individual CDO.

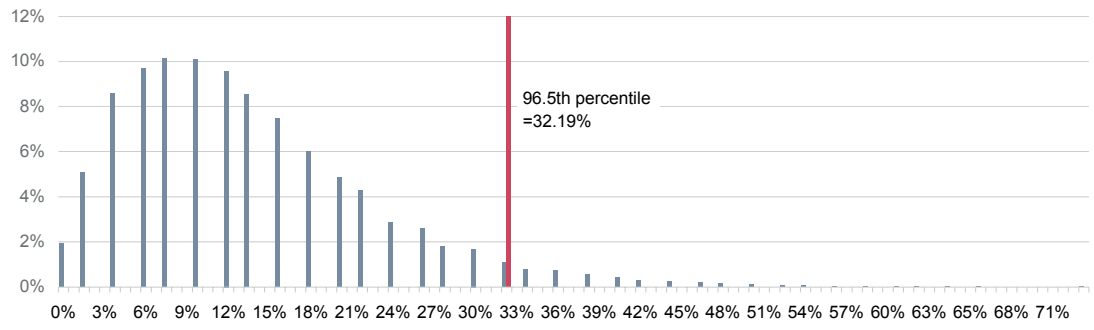
The primary outputs of the VECTOR model are:

- Portfolio Correlation Level
- Rating Default Rate
- Rating Loss Rate
- Rating Recovery Rate
- Default Distribution over Term

Portfolio Correlation Level ("PCL"): The PCL is a pre-simulation, average correlation statistic for the given portfolio in VECTOR, based on Fitch's correlation assumptions. Each industry has a unique correlation profile (see *"VECTOR Methodology"* above) with respect to every other industry, and every portfolio will produce its unique PCL. The PCL enables the user to view the impact of portfolio changes on the portfolio's correlation level. Since correlation has a direct impact on the rating default rate of the portfolio, the purpose of the PCL is to give users an indication of the level of correlation in a portfolio. Changing the correlation, and hence the PCL, will change the default distribution.

Rating Default Rate ("RDR"): The RDR shows the percentage of the initial portfolio that is assumed to default in the respective rating scenario. It is derived

Cumulative Default Distribution



from the portfolio default distribution, applying the percentile corresponding to the rating scenario and term. The percentile applied for a particular target rating incorporates the fact that the values in the Default Matrix are assumed to be average default probabilities. In the chart above, the 96.5th percentile corresponds to a default rate of 32.19%. The RDR is a direct input into the cash flow model (discussed below).

Rating Loss Rate ("RLR"): This is the expected portfolio loss for a particular credit portfolio in the respective rating scenario. The portfolio loss is calculated using Fitch's recovery rate assumptions for each asset, taking into account the asset's jurisdiction, its ranking in the capital structure of the issuer and the rating stress level. The RLR is gross of any structural mitigants such as excess spread. Like the RDR, it is derived from the portfolio loss distribution. In the absence of structural support, static credit enhancement has to cover the RLR for the respective rating.

Rating Recovery Rate ("RRR"): The RRR shows the expected weighted average recovery rate for the particular credit portfolio in the respective rating scenario. In the past, this number was calculated on a pre-simulation basis for all assets in a portfolio, regardless of whether any were likely to default or not.

This simplistic analysis fails to capture two important risk factors. The first is that recovery rates are scenario sensitive. The second is the potential for the bar-belling of recovery rates and ratings. This occurs where ratings are distributed at the extremes around a WARF. If the assets in a pool are not homogeneous, the disparity in default rates could produce substantively different actual recovery rates on a portfolio basis. The extent of the difference depends on the relative difference in default rates.

The VECTOR model captures this difference in the RRR. In the Monte Carlo simulation, each time an asset defaults, its recovery rate in each stress scenario is recorded. VECTOR computes the weighted average recovery rate of all defaulted assets in each simulation run. Those with high default rates will have their recovery rates recorded more often than those with low default rates. As with the RDR and the RLR, the resulting distribution of portfolio recovery rates is used to derive the RRR.

Default Distribution over Term: The default distribution shows the expected allocation of portfolio defaults over the term of the simulation and will be used as a default timing scenario in the cash flow model.

In addition to the above-mentioned outputs, VECTOR will produce various other valuable outputs, all of which are explained in more detail in *"The Fitch Default VECTOR Model User Manual"*, available at www.fitchresearch.com.

Default Risk in Revolving Transactions

Some CDOs are "static", meaning their portfolio of assets is set at closing and does not alter throughout the life of the transaction, bar amortisation or prepayments. In these deals, any principal proceeds are typically paid directly to the most senior class of notes then outstanding as a principal reduction. Other CDOs can be "revolving" or "replenishing", meaning that they have a certain period after deal close during which principal proceeds can be used under certain conditions to acquire new assets rather than pay down senior notes; during this time the outstanding balance of the notes will remain constant, barring defaults. After this period, the transaction begins amortising and effectively converts to a static, or quasi-static, portfolio and any principal proceeds received are used to repay senior notes.

In essence, there may be additional risk in a revolving versus a static transaction in that the portfolio may deteriorate not only by natural migration but also by substitution of assets during the revolving period. In fact, during this period, the portfolio turnover can be much higher than the initial portfolio's weighted average life might indicate. To account for this additional risk and to differentiate revolving structures from static, Fitch will make conservative assumptions regarding a portfolio's migration profile over the term of the transaction. The risk horizon of revolving portfolios, in both cash flow and synthetic transactions, will be modelled as the greater of the initial portfolio weighted average life and that at the end of the revolving period plus the revolving period.

■ Cash Flow Modelling

The VECTOR model focuses on creating unique default patterns for each portfolio. The cash flow model focuses on how the various default and recoveries generated by VECTOR affect the structure of a CDO in different scenarios using the principal outputs of the model (specifically the RDR and the RRR).

Cash flow models test the ability of the structure to withstand various stressful scenarios. Fitch has defined a number of scenarios based on a combination of inputs. These inputs include not only the RDR and the RRR from the VECTOR model but also other inputs such as default timing, interest rate movements and currency movements.

The purpose of the cash flow model is to determine, based on the inputs of the VECTOR model and the defined stress scenarios, whether various classes of CDO liabilities pay in full, in accordance with the terms of the transaction.

Fitch has developed its own independent modelling capability to analyse global CDOs that provides a uniform platform for the analysis of a wide range of transactions and compares their results in a consistent way.

The Fitch cash flow model incorporates the capital structure of the CDO and the payment waterfall. It reflects how the various timing and stress scenarios affect principal and interest proceeds as they are received each period throughout the life of a transaction. The cash flow model then allocates those payments to the various classes of notes based on the rules laid out in each transaction's indenture. If the cash flow model shows that a particular class of notes has received payment in full in the stress scenario for a particular rating, then it is deemed to have passed that stress scenario. Ultimately, while ratings are assigned by a Fitch Credit Committee, which also considers other qualitative factors, passing the cash flow model runs is key to receiving the desired rating.

Modelling Differences Between Synthetic and Cash Flow Transactions: From a modelling perspective, the main difference between the typical cash flow CDO and the typical synthetic deal is the reliance of cash flow CDOs on proceeds from the underlying assets, whereas in a synthetic CDO, investor payments are usually fed by proceeds from the collateral and the protection buyer. In both transaction types, excess spread may be available (see "*Excess Spread*" below), which, depending on the waterfall and structural covenants in the transaction, is either passed through to equity holders or "trapped" by the structure to fund a reserve account and increase credit enhancement. Thus, it can be used to cushion the impact of defaults on the rated notes. Excess spread can replace part of the subordination to achieve the same economics as the rated notes. The key to measuring the degree of reliance on excess spread in a given scenario is the cash flow model.

Many synthetic CDOs either have no excess spread or no excess spread trapping mechanisms and hence there is no need to measure any impact on available credit enhancement via the cash flow model. In this case, credit enhancement levels in a CDO measured by subordination will equal the RLR, which can be determined more directly from the VECTOR outputs – also see "*VECTOR as a Portfolio Management Tool*", page 22.

Timing of Defaults and Recoveries

Defaults

Fitch employs several default timing stresses in the cash flow model. The timing of defaults can have a material impact on the ability of the structure to cope with a given amount of defaults. To see how timing affects excess spread, consider the difference between a front end and back end timing scenario. In a front end scenario, defaults occur shortly after closing and will generally cause overcollateralisation ("OC") tests to fail, triggering the trapping of excess spread, which is then paid as a principal reduction to the senior notes. Thus, a front end scenario captures the maximum amount of excess spread.

In a back end scenario, even though the same amount of defaults occur, they do not peak until later in the life of the transaction. Thus significant levels of excess spread can be paid to the equity holders before the loss of collateral is such that it causes the OC tests to fail and excess spread to be trapped. By the time the excess spread begins to be trapped, there is less of it remaining to be captured because there are fewer periods left in the life of the transaction.

Conversely, a structure that experiences back end defaults may have been able to use earlier periods to build up par value, pay down expensive notes or build up reserve accounts or other structural enhancements that may provide protection against such a scenario.

Given these differences, it is important to test the validity of a structure in multiple timing scenarios. Fitch has four different timing scenarios: base case, front end for IG and sub-IG tranches, and back end. Note that the total amount of defaults will always be the same, regardless of the scenario. The front end timing scenario for an investment grade stress is as follows:

Front-end Timing Default Scenario

Year	Share of RDR (%)
1	33
2	25
3	16
4	13
5	13

Source: Fitch

The sub-IG front-loaded timing scenario applies 100% of the RDR evenly over the first six years of the transaction, equating to 16.67% of the RDR in each of the first six years.

The back end timing scenario back-loads half of the defaults toward the maximum possible weighted average life of the assets. Thus, the peak of the default rate will occur further into a transaction that has long-dated assets and will shorten as the deal seasons. The peak of the defaults is assumed to occur evenly in the three years prior to the average life of the underlying collateral. During this peak, 50% of the RDR is applied; the remaining 50% of the RDR is spread evenly over the prior years of the transaction. In the event that the weighted average life of the collateral is less than six years, 100% of the RDR is spread evenly over the years leading up to the weighted average life.

In order to address the potential defaults of additional collateral purchased during the reinvestment period in revolving deals, Fitch models portfolios with a weighted average life equal to the maximum weighted average life allowed in the deal's governing documents. For example, if a transaction has a maximum weighted average life test of five years and a revolving period of three years, Fitch will model a portfolio with a weighted average life of eight years. To the extent that the deal's governing documents contain a "step-down" schedule (decreasing the maximum allowable weighted average life as the deal progresses through the revolving period), Fitch will calculate the maximum weighted average life that can occur over the revolving period while incorporating all of the "step-down" rules.

For example, assume a collateral pool has a maximum WAL of seven years and an RDR of 20% for the stress scenario in question. The distribution of defaults for the back-end timing scenario is as follows:

Back-end Timing Default Scenario Seven-Year Maximum WAL

Year	Allocation (%)	Amount (%)
1	12.50	2.50
2	12.50	2.50
3	12.50	2.50
4	12.50	2.50
5	16.67	3.33
6	16.67	3.33
7	16.67	3.33
8	0.00	0.00
9	0.00	0.00
10	0.00	0.00
Total	**100.00**	**20.00**

Source: Fitch

Another example shows a collateral pool with a 10-year maximum WAL and a 10% RDR. The distribution of defaults for the back end timing scenario is as follows:

Back-end Timing Default Scenario 10-year Maximum WAL

Year	Allocation (%)	Amount (%)
1	7.14	0.71
2	7.14	0.71
3	7.14	0.71
4	7.14	0.71
5	7.14	0.71
6	7.14	0.71
7	7.14	0.71
8	16.67	1.67
9	16.67	1.67
10	16.67	1.67
Total	**100.00**	**10.00**

Source: Fitch

Additionally, the output of the VECTOR model gives the expected default pattern over the term of the simulation. Fitch will use these results as the base case default timing scenario. For portfolios where the above-described default patterns are not applicable, e.g. because a portfolio is of very short-term nature, or has a very steep amortisation profile after the revolving period, Fitch may adjust the applied default patterns to account for the specifics of the analysed portfolio.

Recoveries

As discussed earlier, in a cash flow CDO, recoveries are realised by either selling the defaulted asset in the market or going through the work-out process. In the interim, the CDO may experience a period of negative carry in that it must continue to pay interest on its liabilities but is not receiving income on that portion of the defaulted portfolio. To capture this risk, Fitch will assume a timing lag in the cash flow model. For US bonds this is six months. For loans, there may be a longer recovery period; therefore, the recovery lag assumptions for US loans is one year. Due to the relative lack of data on defaulted European bonds and loans, the recovery lag for these asset types is assumed to be 18 months and 30 months, respectively.

Amortising Portfolios

While most bonds and loans have bullet maturity dates, some securities, particularly those of ABS and MBS, may have amortising principal schedules. An accurate term for each asset and a simulation horizon for the whole portfolio is a key determinant of the RDR in the VECTOR model output. While bullet assets and amortising assets may share the same average life, it would be naïve to assume that they have the same default profile. It is less accurate to model the default probability of an amortising asset based on its average life, since this approach does not capture what the principal balance of the asset would be at the time of default. This would

overestimate the effect of defaults that occurred during the weighted average life and ignore defaults that could conceivably occur after the end of the weighted average life.

To precisely capture the principal balance at the time of default, the VECTOR model can incorporate an amortisation schedule for every asset in a portfolio. Since the VECTOR model simulates individual asset defaults rather than average portfolio defaults, the principal balance at the time of default and aggregate defaults for each simulation iteration can be calculated at every step of the simulation.

Prepayment Stresses

Any CDO, but particularly those collateralised by structured finance products such as residential mortgages, may receive unscheduled repayment of principal when the underlying borrower refinances all or part of its obligations early to take advantage of lower financing rates. When a bond prepays faster than expected, the notional value of the principal is reduced, thus decreasing the expected future cash flow stream. When a bond prepays slower than expected, its average life extends, causing cash flows to be received later than initially expected. Therefore, when evaluating a transaction, Fitch tests the collateral's cash flows under three different prepayment assumptions. The first is the base case where prepayments are consistent with current expectations. For seasoned securities, the base case rate of prepayments should be an average of the previous six months. For newly issued securities, the prepayment rate base case should be that used to price the securities at issuance. The second case is the extension scenario, where Fitch calculates prepayments to be half current expectations. Finally, the agency examines cash flows in the shortening scenario, where prepayments are double current expectations. Prepayment scenarios are conducted in conjunction with interest rate up and down scenarios However, Fitch does not conduct analysis of non-intuitive scenarios such as fast prepay/interest rates up or slow prepay/interest rates down. For collateral that is not prepayment sensitive, such as CMBS and REIT securities, it is unnecessary to model prepayment stresses.

Treatment of IOs and PIKable Securities

Interest-Only Securities: To increase the spread arbitrage between the coupons on a CDO's underlying assets and outstanding debt, many CDO collateral managers purchase interest-only ("IO") securities. These provide additional interest cash flows that increase excess spread within the CDO structure. To date, collateral managers have primarily purchased IOs exhibiting relatively predictable cash flow characteristics such as CMBS IOs and franchise loan ABS IOs where prepayment "lockout" periods and yield maintenance provisions are included in the issuing trusts.

When evaluating the use of these instruments in CDOs, the following criteria will apply. First, since IOs do not have outstanding principal balances and, hence, no principal cash flows, these securities do not receive any credit in the OC tests, although as they provide interest cash flows, they will be accounted for in the interest coverage ("IC") tests. Second, even though CMBS and franchise loan IOs have a degree of cash flow predictability, it is still prudent to limit a CDO's overall exposure to these securities by restricting the aggregate amortised cost of these investments to a maximum of 5% of collateral assets to reflect the substantial losses that an IO could incur in the event of defaults in the underlying CMBS or franchise loan pool.

CDO Notes and Other PIKable Investments: Due to the attractive spreads that mezzanine CDO tranches offer compared to other subordinated ABS notes, some CDO collateral managers have begun purchasing these securities. As mentioned, many CDO tranches have the ability to pay in kind ("PIK"). The risk of interest deferral may pose a problem since the CDO is relying on the interest received from investments to make interest payments on the issuer's notes. A cash flow mismatch could force a CDO issuer to miss an interest payment on its notes and, therefore, cause it either to default on its senior notes or defer interest on its subordinate notes. To capture the risk of interest deferral in portfolio investments, Fitch assumes that the PIKable investments defer interest when stress testing a CDO's expected cash flows. After the deferral period, Fitch models the remaining PIKable assets to commence paying interest, including the one-off gain of interest previously deferred. Liquidity swaps have been implemented by some issuers to reduce the risk of interest deferral on PIKable assets. Fitch incorporates the benefit of liquidity swaps in its stress testing of PIKable investments.

■ Structural Covenants and Waterfall

Structural covenants and their impact on a transaction's cash flow have a significant impact on a transaction's performance, in particular during periods of increased default rates. In addition, structural covenants can give some guidance as to whether a portfolio manager follows a balanced approach or rather acts for the benefit of a particular class of investor. Structural covenants have been discussed in great detail in "*Enhancing the Structural Foundation of Cash Flow CDOs: What Investors Should Ask*", dated May 19, 2003,

available on Fitch's web site at www.fitchratings.com.

Priority of Payments

Generally, CDO structures include interest and principal waterfalls that dictate the distribution of all proceeds collected, measured on each date on which interest payments on the debt are due. The priority of distributions typically changes as the transaction seasons, i.e. ramp-up period, reinvestment period and amortisation period. Most cash flow structures use interest proceeds generated by the assets to pay transaction expenses such as portfolio management and administrative fees and net hedging costs (if applicable), as well as the interest payments due on the CDO debt. Principal proceeds are typically applied to cover any shortfalls in the interest waterfall and then to either reinvest in additional collateral assets during the reinvestment period or to redeem notes in order of priority during the amortisation period. Fitch's cash flow modelling analyses the impact of a transaction's interest and principal waterfalls on the ability of the rated notes to withstand their respective default levels and cash flow scenarios.

Overcollateralisation and Interest Coverage Tests

Cash flow CDOs generally incorporate OC and IC tests at all rated debt levels. OC tests are designed to ensure that a cushion of OC is maintained throughout the life of the CDO to protect the rated debt from losses on collateral.

Coverage tests, an important component of Fitch's cash flow modelling of each CDO transaction, are performed as frequently as interest payments are made to the debt-holders and whenever assets are deleted from or added to the portfolio. If coverage tests are failing, cash flows are redirected to redeem notes in order of priority until the failing coverage test is cured.

Fitch looks at the assumptions behind the OC levels. Overly tight test levels relative to the initial OC ratios can lead to easily breached OC tests. When a trigger is tripped, interest that would normally be payable to subordinate classes is redirected to redeem notes in order of priority until compliance with the breached OC test is restored. Principal proceeds may also be used to redeem notes to cure the failing OC test if interest proceeds are insufficient.

Cash flows that would otherwise pay interest to junior rated notes should only be redirected when there is real doubt as to the adequacy of protection available for rated notes over the life of the transaction. For this reason, Fitch welcomes reinvestment diversion tests that, if breached, redirect excess spread towards the purchase of additional collateral securities, and thereby help mitigate any erosion of par value.

Performing assets are typically valued at par for the OC tests, while defaulted assets are valued at the lower of market value or assumed recovery value. At times, Fitch may value the defaulted asset at a price that the portfolio manager believes reflects the asset's ultimate value. Fitch reviews the prices at which assets are purchased for a CDO, and will review the credit quality of any assets purchased at a substantial discount to par. In certain circumstances, it may be appropriate to value discounted assets at a price other than par when calculating the OC tests. For further discussion see "*Treatment of Discount Securities in Cash flow CDO Tests*", dated 11 March 2003, available at www.fitchratings.com.

A portfolio manager may sell credit-impaired assets at a discount and should be allowed to do so if he believes the optimal price is being offered. A credit-impaired asset can generally be defined as one that the portfolio manager believes is at risk of declining in credit quality and, with the passage of time, will have a high probability of default. However, since a credit-impaired asset is carried at par until sold, the OC level will fall immediately upon its sale unless it is exchanged for another asset purchased at a discount. Alternatively, the portfolio manager may make up for the reduction in OC by selling assets trading at a premium to par.

IC tests validate the arbitrage between the yield on the portfolio assets and the cost of the CDO debt. Maintenance of the IC tests ensures that there are sufficient interest proceeds to cover funding costs for a particular period.

Excess Spread

Excess spread can be defined as interest proceeds net of transaction fees, expenses and interest due on rated notes. It can form an important component of credit enhancement for the rated notes, but can only be determined through detailed cash flow modelling. Structural features within a CDO, such as priority of payments, coverage tests and the amount and position of fees and expenses in the payment waterfall, can have a dramatic impact on the level of excess spread available either to redeem notes or reinvest in additional collateral. Despite some differences, the two uses of excess spread both bring about a deleveraging of the structure by enhancing OC and boosting the ratio of income to expenditure. Fitch conducts comprehensive cash flow modelling in order to understand the impact of excess spread in a particular CDO and its influence on the credit enhancement of each tranche of rated debt.

Available Cash Investments

Many cash flow CDOs will hold some cash from principal or interest payments either until the next payment date or until the available amounts are reinvested in other collateral. In particular, in cases where significant amounts of cash are held, the interest earned thereon over time can have an impact on the overall performance of the transaction.

Fitch makes an assumption about the amount of cash on the balance sheet of the CDO in each period and assumes that interest on this amount is earned at EURIBOR/LIBOR minus 1%. Principal repayments on the underlying obligations in the portfolio are presumed to be received by the CDO midway through a period. That cash is presumed to earn interest at the coupon rate of the underlying collateral for half of the period and EURIBOR/LIBOR minus 1% for the remainder.

Fees and Expenses

The fees and expenses associated with issuing and managing a CDO structure have a bearing on the level of credit enhancement available to the rated debt. Structuring fees, legal fees and upfront expenses are typically paid out of the structure at close. The aggregate amount of initial fees and expenses influences the net proceeds of the debt issuance that may be available to invest in portfolio collateral; excessive initial fees and expenses may give the portfolio manager the incentive to purchase collateral at a discount to par to make up for any shortfall. Fitch monitors the amount of initial fees and expenses closely to ensure that they are in line with market practice. Furthermore, the agency believes that it is a benefit to the structure to have a portion of the initial fees and expenses deferred so as to allow the portfolio manager to invest as much of the issuance proceeds as possible.

Ongoing fees and expenses of the CDO, such as portfolio management fees, should be balanced as equitably as possible in the interest waterfall. By distributing portfolio management fees evenly between senior and subordinate positions in the waterfall, the portfolio manager is more aligned with all of the noteholders' interests. Furthermore, the amount and position of ongoing fees and expenses may also affect the amount of excess spread available to the rated notes as credit enhancement. The more ongoing fees and expenses are senior in the interest waterfall, the less excess spread is available. Fitch incorporates all the upfront and ongoing fees and expenses in its cash flow model to ensure that there is sufficient credit enhancement for the rated notes throughout the tenure of the transaction.

Treatment of Distressed and Defaulted Securities

This section covers the inclusion in a CDO of distressed and defaulted assets. The VECTOR model produces a distribution of defaults using inputs such as the rating and life of a portfolio of securities. As such, it is a "forward-looking" tool used to predict the level of defaults in the future for a given portfolio of assets. The analysis that VECTOR performs does not apply to assets that have already defaulted or are distressed to a point where their default is highly likely or imminent. The inclusion of a distressed obligation in a CDO portfolio is fairly uncommon, but for the few transactions where this is the case, they are handled on a case-by-case basis (see "*Fitch's Approach to CDO Rating Actions*", dated 6 February 2002, available at www.fitchratings.com).

Distressed and defaulted assets are treated differently in the cash flow model. Defaulted assets are included at the lower of assumed recovery rate and market value. The latter is discussed with the asset manager, together with the manager's view on the expected holding period for the defaulted asset. Defaulted assets are typically in a non-accrual state during their workout, which produces negative carry for the CDO.

Distressed assets have not yet defaulted but their value and/or their performance has deteriorated to the point where default is likely in the near term. In many cases, default is imminent but in some cases (particularly ABS), it may not occur for some time, even though, ultimately, it is virtually inevitable. Distressed assets where default is imminent are more typically corporate bonds and loans. In these cases, prices are usually quoted in the secondary market as a percentage of par rather than on a yield basis. If the expected default is less than a year away, Fitch will typically treat the asset as if it is already in default in the cash flow model. The discussion with the manager will also include some expectation of the timing of workout to ensure that the cash flow model will contain the most realistic view of the portfolio. The model will reflect the imminent default of the distressed asset, the time lag to recovery and expected recoveries on a case by case basis.

Distressed ABS are a special case because they do not default in the same manner as corporates. Distressed ABS can follow a number of different payment patterns. These include:

- current pay on interest to maturity but no return of principal (it turns into an IO);
- the security defers interest (PIKs) until maturity, then pays a portion of the accrued interest and principal (it turns into a PO);

- pays interest intermittently until maturity with some principal at that time;
- any combination of the above.

Fitch's CDO and ABS teams together construct the most likely payment structure for each distressed ABS, which the cash flow model is updated to reflect. This gives the Fitch analysis a more nuanced view of the performance of the CDO than simply modelling the assets as performing or non-performing.

Interest Rate and Currency Risks

Interest rate or currency risk arising from a mismatch between the assets that constitute the CDO collateral and the liabilities may leave the issuer exposed to adverse movements in interest or exchange rates. This is typically hedged to a large extent either through matching both assets and liabilities in their composition of different currencies/interest rates ("natural hedge") or through derivatives, primarily swaps, but also caps, floors, forwards and options.

Nevertheless, despite the hedge, the CDO may remain exposed to interest rate and currency risk due to un- or over-hedged positions following defaults, prepayments and substitutions in the underlying portfolio. As a result, derivative hedge positions may have to be terminated, which may lead to the issuer paying breakage costs to the swap counterparty (unless the swap allows for early termination with no penalty). The amount of breakage costs owed is typically the difference in net present value ("NPV") of the future payments between the two legs of the hedge.

Fitch stresses interest and currency exchange rates to reflect the required rating category of the notes based on historical movements in the relevant index (see methodology box) to ensure that investors are adequately protected.

Interest Rate Risk

Fitch developed interest rate stresses for cash flow transactions for USD LIBOR, GBP LIBOR and the European Interbank Offered Rate (EURIBOR). Interest rate stress scenarios are naturally more severe for investment grade stress runs. In the case of EURIBOR, the structure is subjected to an additional absolute rate increase of 4.3% at 'AAA' during year one. This is applied periodically (according to the payment frequency on a CDO) to the rate at closing. Further increases of 2.2% and 1.0% are then applied in year two and three, respectively. As interest rates are assumed to be mean reverting and to take account of the particular overall stress scenario, Fitch reduces the rate in year four by 1.4%, which is applied for the remainder of the transaction's life. The methodology is the same for the other rating levels and interest rates. The respective stress levels for each of the three indices and rating levels are outlined in the tables below.

3 Month USD LIBOR

(%)	Year 1	Year 2	Year 3	Year 4	Total
AAA	+3.8	+0.4	0	0	**+4.2**
AA	+2.8	+0.5	0	0	**+3.3**
A	+2.3	+0.6	-0.4	0	**+2.5**
BBB	+1.8	+0.8	-0.2	0	**+2.4**
BB	+1.4	+0.7	-0.2	0	**+1.9**

Source: Fitch

3 Month EURIBOR

(%)	Year 1	Year 2	Year 3	Year 4	Total
AAA	+4.3	+2.2	+1.0	-1.4	**+6.1**
AA	+3.7	+1.9	+0.8	-1.1	**+5.3**
A	+3.1	+1.7	+0.7	-1.1	**+4.4**
BBB	+2.6	+1.2	+0.5	-0.9	**+3.4**
BB	+1.9	+1.0	+0.5	-0.6	**+2.8**

Source: Fitch

3 Month GBP LIBOR

(%)	Year 1	Year 2	Year 3	Year 4	Total
AAA	+4.9	+2.5	+1.1	-1.6	**+6.9**
AA	+4.2	+2.2	+0.9	-1.3	**+6.0**
A	+3.5	+1.9	+0.8	-1.2	**+5.0**
BBB	+2.9	+1.4	+0.6	-1.0	**+3.9**
BB	+2.2	+1.1	+0.6	-0.7	**+3.2**

Source: Fitch

Fitch also runs interest rate down scenarios, relevant in the event of over-hedging, which could be the result of defaults in an underlying portfolio (see "*The Effect of Interest Rate Swaps on Arbitrage Cash Flow CDOs*", dated 6 May 2002 and available at www.fitchratings.com). Given the assumption of mean reversion, the applied interest rate down stresses mirror the interest rate up stresses, subject to a floor of 25bps.

Currency Risk

Fitch analysed historical USD, EUR, JPY and GBP price movements. The table overleaf shows the log scale stress factors for the EUR/USD exchange rate over a 10-year period. These are continuous time log scale stress factors denoted as "S_t" in the following formula:

$$E_t = E_{closing} * e^{St}$$

As in the case of interest rates, Fitch runs both appreciation and depreciation scenarios. In the above example, the agency assumes the EUR will appreciate over the first year by 39.9% on a log scale. Over two years, the assumed appreciation is 49.2% on a log scale, which would result in an exchange rate of 0.6115 assuming an original rate of 1. The

next table shows the exchange rate path for the EUR/USD rate in a 'AAA' scenario, assuming the rate is 1 at closing.

EUR/USD Log Scale Stress Factors

	Variation EUR/USD (%)	
Year	AAA Depreciation	AAA Appreciation
1	42.9	-39.9
2	55.0	-49.2
3	65.0	-55.3
4	74.1	-62.2
5	87.4	-71.4
6	96.1	-78.6
7	96.1	-78.6
8	96.1	-78.6
9	96.1	-78.6
10	96.1	-78.6

Source: Fitch

EUR/USD 'AAA' Stress Actual Exchange Rate Change

	Variation EUR/USD (%)	
Year	AAA Depreciation	AAA Appreciation
1	1.5351	0.6713
2	1.7329	0.6115
3	1.9165	0.5755
4	2.0984	0.5366
5	2.3959	0.4898
6	2.6142	0.4558
7	2.6142	0.4558
8	2.6142	0.4558
9	2.6142	0.4558
10	2.6142	0.4558

Source: Fitch

For a more detailed description of the application of currency stresses, see "*Fitch Ratings' Approach to Foreign Exchange Risk in Collateralised Debt Obligations*", dated 26 March 2003 and available at www.fitchratings.com. Fitch's detailed currency assumptions for GBP, USD, EUR and JPY are available at the same address as an excel file "FX Stresses (*Excel Spreadsheet*)" at www.fitch-ratings.com.

Methodology behind Fitch's Currency and IR Stresses

Fitch's currency and interest rate stresses were derived using historical data as opposed to using market expectations implied by the forward curves. The analysis was based on the standard deviation (STDEV) of changes in the respective interest and currency rates as well as actual distribution of movements in each rate over the sample period. The individual stresses were determined as the minimum of the multiple of the STDEV and the worst-case changes corresponding to a particular confidence level for each rating scenario.

Currency Stress

Fitch analysed the historical price movements of the USD, EUR, JPY and GBP over a period starting in 1988 for USD, EUR and GBP and 1980 for JPY. Prior to 1988, the USD, EUR and GBP displayed greater volatility associated with the high inflation experienced by many countries during that period, a trend Fitch believes is unlikely to be repeated. It also believes the JPY to be more volatile than the other major currencies and, therefore, included the more volatile pre-1988 period.

Interest Rate Stress

Fitch analysed the absolute rate changes in 3 month EURIBOR, 3 month USD LIBOR and 3 month GBP LIBOR. For the period prior to the introduction of EURIBOR, the agency used the ECU LIBOR computed by the British Bankers' Association as a proxy. The final data sample included daily rates starting in 1984 in the case of USD LIBOR, 1989 for EURIBOR/ECU LIBOR and 1987 for GBP LIBOR. As in the case of currency rates, the volatile period of the early 1980s was excluded. While the EURIBOR/ECU LIBOR rate was the least volatile of the three, the agency increased the stress factors due to the lack of a track record at the European Central Bank and the limited data history of EURIBOR.

■ Relevant Parties and Counterparty Risk

Asset Manager and Originator

Originator Review

An important pillar of Fitch's rating process for a CDO is an assessment of the capabilities of the originator, servicer or portfolio manager ("manager") to service or manage the CDO. The agency recognises that the manager's performance is vital to the performance of all rated tranches of the CDO, particularly the most subordinate. Therefore, it will undertake this assessment in the context of the type of CDO under review – for example, a managed synthetic CDO, a balance sheet CDO with limited substitution rights or a managed cash flow arbitrage CDO – as each type of CDO requires different manager capabilities to successfully service or manage a CDO.

Fitch's information requirements for a manager review are supplemented and tailored according to the characteristics of the CDO and the motivations of each deal. The agency will assess the manager's capabilities by conducting an on-site review, the starting point for which will be gaining an insight

into how the CDO fits within the overall business strategy of the company. When evaluating managers, Fitch looks for expertise in relevant asset classes included in the CDO portfolio (e.g. IG or HY corporates, ABS or MBS), especially during an economic downturn, and preferably within a CDO context. During the on-site review, representatives of the agency will hold interviews with senior management and key personnel involved in the origination, management and administration of the underlying portfolio. Fitch will further examine relevant documents, including credit analysis and investment management procedure manuals. Following the on-site visit and completion of the review of the relevant documents, Fitch analysts prepare a comprehensive appraisal of the manager, which is presented to an internal Credit Committee for approval. The results of these reviews play a substantive role in determining structural flexibility in managing the CDO.

CDO Collateral Asset Manager ("CAM") Rating

Like all investment funds, CDOs are subject to investment manager risk, characterised as the potential failure on the asset manager's part in some measure to select good investments, effectively anticipate and act on market movements and/or otherwise execute an investment strategy consistent with the interests of the investors. Some CDO asset managers, in particular in managed cash flow arbitrage and synthetic arbitrage CDOs, have consistently outperformed others managing comparable portfolios of the same vintage, while others have consistently underperformed. In recognition of the importance of the manager's capabilities, Fitch introduced its CDO CAM rating programme in 2002. Under a CDO CAM rating, Fitch undertakes a comprehensive in-depth analysis of specific categories critical to the manager's performance, which it publishes in separate ratings reports, detailing its assessment and findings. CDO CAM ratings are reviewed on a regular basis and updates are published as and when warranted. Using Fitch's CAM rating, it will be possible to benchmark managers against each other and increase transparency in the market.

Fitch's CDO CAM rating review procedures include the use of qualitative and quantitative metrics to rate CDO asset managers by asset class in each of nine groupings of evaluation criteria as listed below.

1. Company and management experience.
2. Financial condition.
3. Staffing.
4. Procedures and controls.
5. Credit underwriting/asset acquisition.
6. Portfolio management.
7. CDO administration.
8. Technology.
9. Portfolio performance.

Fitch's CAM rating methodology is based on asset-type-specific scorecards that provide a systematic means of measuring the relative strengths and weaknesses of CDO asset managers. The methodology facilitates the consistent application of criteria while minimising subjective variations in scoring qualitative characteristics, accomplished through the use of a scoring guide that defines all possible scores for each criterion using a scale of 1 to 5, with 1 being the best. Each factor is assigned a weight appropriate to its relative importance or bearing on the category rating.

The CAM ratings will be used to enhance Fitch's credit rating analysis and provide investors with its views on an asset manager's capabilities. The primary considerations will revolve around determining the balance between an asset manager's experience, strengths and track record, and the requirements of specific CDOs. For more information on Fitch's CDO CAM programme, see "*Rating CDO Asset Managers*", dated 13 February 2004 and available at www.fitchratings.com.

CDO CAM Rating and Credit Ratings Analysis

As already mentioned, a recent enhancement to Fitch's ratings criteria was the implementation of a systematic application of CDO CAM ratings in its CDO credit ratings criteria. Depending on the agency's assessment of a manager, as embodied in its CAM rating, Fitch will recognise stronger managers by applying lower expected collateral defaults in its cash flow modelling and, potentially, greater CDO structural flexibility.

To establish a quantitative link between CAM ratings and CDO ratings, Fitch has developed a system designed to capture the combined effects of asset manager attributes, as measured by CDO CAM ratings, to adjust stressed default rates at each rating level. The approach can be summarised as follows:

- A composite CDO CAM rating is calculated for each of nine categories weighted as listed in the table opposite. Occasionally, Fitch will not assign a Portfolio Performance category rating due to limited CDO track record for any particular manager. In these cases, the weights for the remaining categories will be adjusted accordingly to arrive at an overall rating. Furthermore in these cases, the agency will not give full credit for any stress reduction.

- This composite rating is used to calibrate the maximum allowable adjustment to the RDR of the corresponding rating levels in accordance with the matrix below.

Composition of CDO CAM Rating by Category

	Weight (%)
Company and Management Experience	10
Financial Condition	5
Staffing	12
Procedures and Controls	5
Credit Underwriting	15
Portfolio Management	12
CDO Administration	8
Technology	8
Portfolio Performance	25
	100

Source: Fitch

In cases where the asset manager does not have a sufficient CDO performance track record on which to base a performance score, the remaining eight categories will be weighted as follows:

Composition of CDO CAM Rating by Category – No Performance History

CDO CAM Rating Category	Weights (%)
Company and Management Experience	13
Financial Condition	7
Staffing	16
Procedures and Controls	7
Credit Underwriting	20
Portfolio Management	16
CDO Administration	10
Technology	11
	100

Source: Fitch

Composite scores which are calculated without a performance score will be increased by 20% to establish the final composite score. For example, the final score for a manager with a composite of 2.30 will become 2.76 (2.30 X 1.20) if performance is not scored in the composite calculation.

Therefore, Fitch will make the distinction between CDO asset managers directly in its modelling assumptions. Since the performance of the asset manager is critical to the subordinate classes of debt, the CAM rating will weigh more heavily on Fitch's analysis of these classes.

For more information on Fitch's processes and criteria for CDO asset managers, see the report entitled, "*Rating CDO Asset Managers*", available on Fitch's web site at fitchratings.com.

Counterparty Risk

As well as being directly linked to the performance of a securitised portfolio, ratings are often dependent on the financial strength of certain counterparties. In CDOs, counterparty risks arise in all situations where the CDO issuer relies on payments made by a counterparty. This can include counterparties to transaction accounts, interest rate swaps and currency swaps, counterparties that provide credit exposures, either in a true sale or synthetic structure, and bank loan participation counterparties. In addition, in synthetic CDO structures, the issuer can be exposed to counterparty risk under any collateral arrangements supporting the payment obligations of the CDO. Fitch's approach to counterparty risk is that the risk introduced into the transaction must be commensurate with the rating on the highest-rated notes. If a de-linkage of the notes against any counterparty risk is not assured, dependent on the exposure at risk, additional credit enhancement may be required to capture the risk introduced by the counterparty, or the rating of the notes may be credit-linked to the Long-term rating of the respective counterparty.

Structural de-linkage is usually achieved by the introduction of rating triggers, under which a downgrade of the counterparty at risk will trigger appropriate action so as to mitigate the additional risk from a downgrade. Typical measures to mitigate the increased credit risk are:

- Replacement of the downgraded counterparty with an entity whose rating is commensurate with that of the affected notes.

Adjustments to RDR by CAM Rating

	CDO CAM Rating					
	'CAM1'	'CAM2'	'CAM3'		'CAM4	'CAM5'*
Composite (%)	1.00 – 1.50	1.51 – 2.25	2.26 – 3.00	3.00 – 3.50	3.51 – 4.00	>4.00
"AAA"	5.00	2.50	None	None	-5.00	n.a
"AA"	8.00	4.00	None	None	-7.50	n.a
"A"	10.00	5.00	None	None	-10.00	n.a
"BBB"	12.50	8.00	4.00	None	-12.50	n.a
"BB	17.00	12.00	7.50	None	-17.00	n.a

* Fitch will not rate new issue CDO liabilities involving asset managers with an initial rating of 'CAM5'.
Source: Fitch

- Coverage of the counterparty's obligations by a guarantor whose rating is commensurate with that of the affected notes.

- Posting of collateral covering the counterparty's potential payment obligations. The rating of the collateral must be commensurate with that of the affected notes and the amount of collateral to be provided depends on whether a non-payment of the counterparty leads to an early termination of the transaction or not.

- Advance payment of all the counterparty's obligations, effectively equivalent to posting collateral.

The rating thresholds which will trigger the above mentioned measures vary between 'F1+' and 'F1', depending on the complexity of the instrument and the amounts at risk. For swaps, for example, Fitch will always default to the upper rating boundary when the amount at risk is equal or close to the swap notional.

VECTOR as a Portfolio Management Tool ("PMT")

Since early 2004, arrangers have begun to use VECTOR with synthetic CDOs to model the impact of substituting new credits into a transaction. By testing a revised pool of credits with VECTOR, an issuer can see the impact of substitutions on the RLR. The use of VECTOR as a PMT replaces Fitch's reliance on some of the conventional eligibility criteria and provides a more flexible assessment of the portfolio credit quality. For example, with VECTOR as a PMT, it would be possible to substitute assets with a lower expected recovery rate if this is offset by a higher rating. Previously, the rating and recovery rate were limited by individual eligibility criteria such as the maximum WARF and weighted average recovery rate. Despite using VECTOR as a PMT, these criteria may remain important to investors. Furthermore, Fitch does not require the use of VECTOR in this way, but rather offers it as one PMT option that an issuer may use to manage substitutions.

In synthetic transactions, VECTOR is directly applicable where transaction requirements are, simply, to maintain the RLR after substitution within the level covered by the credit enhancement in the transaction. In addition to VECTOR's output, it may be appropriate that certain substitution criteria are maintained, such as a minimum WARF. The usual methodology would be that the transaction documentation would require the portfolio to be tested prior to, or on, a substitution date. This test would measure whether, for the relevant tranche, the RLR, consistent with the original rating of the tranche, is less than or equal to the current credit enhancement level for that tranche. In certain circumstances, e.g. when a portfolio is already in breach of the test prior to substitution, further substitution that does not bring the portfolio back to compliance may be permitted, provided it does not have an adverse effect on the credit quality of the portfolio.

It should be noted, however, that compliance with such a test does not imply any affirmation, upgrade or downgrade of the then-current ratings assigned by Fitch. It may also be the case that a structure uses an amended version of VECTOR, or inserts specific collateral recovery rates agreed with the agency. Again in this case VECTOR is used as a PMT, but does not form a rating affirmation. Fitch retains the ability to review and adapt its methodology for rating the transaction.

In contrast, cash flow transactions can maintain their rating, and support an RLR which fluctuates through the life of the transaction, because structural devices such as excess spread release/trapping, hedging, and reserve accounts may provide additional and variable credit enhancement. Therefore, using VECTOR as a PMT in cash flow transactions would need to incorporate some cash flow modelling. For a small number of European transactions Fitch has worked with issuers to develop testing which gives some credit to excess spread; in other cases market participants have not opted to pursue this due to the increased level of testing required.

Waterfall Requirements for Swap Payments

Upon a termination of a swap, under the normal ISDA swap convention (the so-called "Second Method"), a make-whole payment becomes due to the counterparty in favour of which the swap is in the money, regardless of whether the termination was caused by the default of this counterparty. To avoid this potential shortfall in proceeds due to a counterparty default, the issue documentation should include provisions ensuring that only the defaulting party is potentially liable to make payment if an early termination results from an event of default. Alternatively, such payment can be fully subordinated to the redemption of all rated notes.

Collateral Guidelines for Synthetic CDOs

In most funded synthetic CDO transactions, the investment of note proceeds in collateral serves a dual purpose: it is pledged to the protection buyer under the CDS to reimburse any credit losses on the reference portfolio and it covers the principal payments due under the CDO. Collateral cash flows

may be jeopardised in two ways: potential market value risk if the collateral needs to be liquidated to make any of the above-mentioned payments, and potential credit risk if the redemption of the notes is dependent on the performance of the collateral issuer.

To address market value risk, Fitch's collateral guidelines are designed to ensure that collateral can be liquidated at par at any time an issuer payment may become due. For term collateral, market value risk can be mitigated by structural protection in the form of a put option at par, an asset swap or a repo agreement. Again, rating triggers should be set to protect against counterparty default risk. Alternatively, appropriate OC (based on the liquidity of the collateral) coupled with regular marking-to-market may serve the same purpose. Moreover, any cross-currency exposure between the collateral and the notes should be immunised.

To mitigate collateral credit risk, the note proceeds should be invested in highly rated collateral, commensurate with the assigned rating on the notes. Generally, for notes to achieve a 'AAA' rating, the collateral should carry a rating of 'AAA'. To de-link the notes from the collateral, structural covenants may be incorporated requiring the substitution of the collateral upon its downgrade below 'AAA'. The counterparty, usually that covering the market value risk, should offset any costs of the replacement. When the collateral is of a short-term nature (usually cash) and structural protection triggering its transfer upon its downgrade is available, Fitch may default to a Short-term rating of 'F1+'. When collateral and collateral payments on the various tranches issued by an SPV are totally segregated from each other, each issued tranche of notes can be collateralised separately.

If no measures are taken to de-link the note ratings from the collateral rating, then the ratings of the notes will be capped at the Long-term rating of the collateral. If more than one asset is given as collateral, noteholders are exposed to the risk of the default of the first asset in the collateral pool. Consequently, Fitch will analyse this structure in line with its First-to-Default methodology (see "*Rating nth to Default Basket Credit Linked Notes*", dated 22 January 2003 and available at www.fitchratings.com).

■ Legal Issues

The most important legal considerations for CDO transactions are the bankruptcy remoteness of the issuer, non-consolidation, validity of transfer, perfection of security interests in the collateral and the enforceability of the various agreements governing the parties to the transaction.

Bankruptcy Remoteness of the Issuer: Assets should be isolated from the creditworthiness of the transferor to limit the risk that such assets may be clawed back by a bankruptcy official of the transferor, i.e. either the originating bank or the selling agent. For clarity, in 'claw-back' risk, i.e. the likelihood that the issuer's assets will fall under the bankruptcy estate of the transferor, Fitch's key concern relates to CDOs where the assets are held on the balance sheet of the transferor prior to transfer to the SPV. This concern is usually addressed by a legal opinion confirming that a true sale to the SPV has taken place as opposed to it providing a loan to the SPV. This is not a concern where the transferor is an asset manager buying the collateral from selling agents in the secondary market and it is not held on its balance sheet. In the latter, the risk of claw-back is less significant because a sale to an SPV conducted on an "arm's length basis" (market-based pricing) is unlikely to be challenged by a transferor bankruptcy official.

Non-Consolidation: Another concern is whether the insolvency of the controlling shareholder of the SPV will result in the assets of the SPV being pulled into such shareholder's bankrupt estate, thereby making such assets available to the combined creditors of such shareholder and the SPV. Fitch will need comfort that this will not occur.

Validity of Transfer and Perfection of Security Interests in the Collateral: Fitch needs to be comfortable that the SPV has proper ownership of its assets and that the noteholders have a perfected interest in the relevant collateral.

Enforceability of the Various Agreements: Fitch will seek comfort that the transaction documents constitute legal, valid, binding and enforceable obligations of the parties and that the choice of law governing the documents will be recognised by the courts of the relevant jurisdiction. Fitch will also need comfort that no adverse tax consequences will affect the SPV unless they are quantified. In such a case, they will be taken into account in the quantitative analysis of the CDO transaction.

Fitch will review all documents relevant to the proposed securitisation, including opinions as to the legal issues previously described.

■ Performance Analytics

Monitoring the performance of a CDO is a critical part of maintaining the ratings on a transaction over its life. Reviewing the composition and performance of a portfolio on a regular basis allows Fitch to pass on accurate and timely information and commentary to subscribers. Remittance reports are typically

received and reviewed on a monthly basis, the actual frequency depending on the nature of the transaction. Outstanding ratings are formally reviewed annually, but may be reviewed more frequently, as warranted by events, to maintain timely ratings on all Fitch rated CDOs. The result of every review will be communicated in a press release. Fitch is committed to providing subscribers with substantive transaction analysis and commentary as part of its performance-related products via its performance analytics products, available at www.fitchresearch.com.

■ Related Research

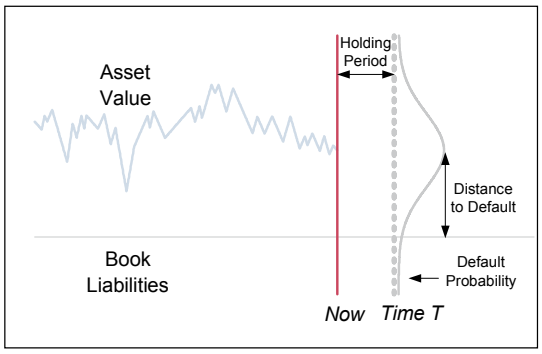
The following research is available on the Fitch web site at www.fitchratings.com:

- *"Regimes, Recoveries and Loan Ratings: The Importance of Insolvency Legislation",* 11 October 1999
- *"Secured Loan Recovery Rate Study – The UK Experience",* 29 February 2000
- *"Evaluation of Bank Internal Risk Grading Systems",* 23 July 2001
- *"European SME CDOs: an Investor's Guide to Analysis and Performance"* 2 October 2001
- *"Fitch's Approach to CDO Rating Actions",* 6 February 2002
- *"The Effect of Interest Rate Swaps on Arbitrage Cash Flow CDOs",* 6 May 2002
- *"Rating Criteria for US Middle Market Collateralized Loan Obligations",25 June 2002*
- *"New Approach for Structured Finance CDO Collateral Review",* 18 July 2002
- *"Standardized Documentation for Credit Derivatives Growth",* 16 October 2002
- *"Managed Synthetic CDOs", 22 January 2003*
- *"Dynamic Funding in Cash Flow Arbitrage CDOs"*, 21 February 200*3*
- *"Fitch Examines Effect of 2003 Credit Derivatives Definitions"*, 6 March 2003
- *"Treatment of Discount Securities in Cash Flow CDO Tests",* 11 March 2003
- *"Fitch Rating's Approach to Foreign Exchange Risk in CDOs",* 26 March 2003
- *"Enhancing the Structural Foundation of Cash Flow CDOs: What Investors Should Ask",* 19 May 2003
- *"U.S. Structured Finance CDO Performance"* 10 Sep 2003
- *"'Fitch 2002 U.S. CDO Transition Study and First-Half 2003 Recap",* 15 Sep 2003
- *"Fitch 2002 U.S. Structured Finance Rating Transition Study",* 2 Oct 2003
- *"CDO Squared: A Closer Look at Correlation",* 2 Feb 2004
- *"Rating CDO Asset Managers',* 13 February 2004
- *"Synthetic Structured Finance CDOs",* 17 Feb 2004
- *"Default Correlation and its Effect on Portfolios of Credit Risk", dated 17 February 2004*
- *"Middle Market CLO Performance Update: 2003",* 1 Mar 2004
- *"Credit Events in Synthetic CDOs: Year End 2003 Update",* 11 June 2004
- *"Global Structured Finance Ratings Performance: First-Half 2004 Review"* 19 Jul 2004
- *"Fitch Ratings Corporate Finance Rating Transition and Default Study",* 19 July 2004
- *"Synthetic Index – July 2004",* 29 July 2004

■ Appendix 1

Structural Form Models/Monte Carlo Simulation

Structural Form Models are widely used in evaluating the credit risk of individual firms or credit portfolios including CDOs. They are based on option pricing theory and were first developed by Black Scholes and Merton. The approach is built on the assumption that companies default if the value of their assets falls below the value of their liabilities (also referred to as default threshold). Graphically this is shown in the chart on the right. The probability of default pi for the issuer i can therefore be expressed as the probability that the value of the assets (Vi) falls below the default threshold (Di).



$$p_i = \Pr(V_i \le D_i)$$

Structural Form Models can be used in conjunction with Monte Carlo simulation to approximate the default distribution of credit portfolios. In the Monte Carlo framework the change in asset values is typically assumed to follow a particular distribution. For ease of computation, most models use the normal distribution due to its well-defined characteristics. In each simulation run, a standard normal random number is drawn for each name in the portfolio, representing the change in the obligor's asset values over the holding period or the time to default. The default threshold can be inferred from the default probability, which, in the VECTOR model, is derived from an obligor's rating and the Fitch CDO Default Matrix. For example, the default rate for a 'BBB' rated entity over five years is assumed to be 1.89%. The default threshold can be computed by using the inverse of the standard normal cumulative distribution as follows:

$$\Phi^{-1}(1.89\%) = -2.08$$

Most models today define the holding period as the time to asset maturity and draw a single random number representing the change in asset value until maturity of the asset. Such single-period models, while they are fast, do not allow for changes to the inputs such as correlation and default probabilities over time. Fitch has adopted a multi-period approach in its VECTOR model, with a holding period of one year. For each year of a transaction's life, the VECTOR model repeatedly applies the single-period model. For example, for assets that survive in the first year, the model assigns a second standard normal random variable representing the change in asset value over the second year, and so on until maturity. This allows the incorporation of time vary parameters such as correlation and default probabilities. The default threshold for each period is based on the conditional probability of default derived as follows:

$$p_{conditional;k|k+1} = \frac{p_{marginal;k|k+1}}{1 - p_{cumulative;k}} \quad \text{where} \quad p_{marginal;k|k+1} = p_{cumulative;k+1} - p_{cumulative;k}$$

Structural Form Monte Carlo simulations are appealing as they can be easily extended to take into account the correlation between the asset values of individual obligors in a portfolio. This is typically achieved through the use of copula functions, of which the standard Normal Copula is the most widely used (also used in the VECTOR model). A copula function is, essentially, an approximation of the joint asset value distribution for the obligors in a portfolio. The marginal distributions are linked through asset correlation. Mathematically, this is achieved through the use of Cholesky decomposition. The resulting correlated normally distributed asset values are again compared to the respective default threshold. For the bi-variate normal distribution, the probability that both assets default (joint probability of default) is represented by:

$$P(V_A < D_A \cap V_B < D_B) = \Phi(D_A; D_B; \rho_{AB})$$

Appendix 2

Empirically Derived Asset Correlation by Industry

The following describes the methodology underlying the correlation assumptions used in VECTOR for corporate industries. To measure the equity return correlation a factor analysis is applied. Factor models are based on the notion that a number of common "drivers" – factors – of the stock market can explain the returns on a stock over time. The factors can be thought of as capturing the effects of economic forces, potentially unobservable, that have an impact across "many" businesses and thus affect all or certain groups of stocks.

Factor analysis can be based either on existing economic variables used as factors or on statistically determined factors, which are implicit in the data set. Both methodologies have their advantages and disadvantages. For example, using economic variables as proxies is similar to structural macroeconomic models for the economy, which are generally poor in their predictive power. Moreover, these models are less able to accommodate changes in the economy. On the other hand, the results of statistical models are generally more difficult to interpret as they do not necessarily correspond directly to economic variables. However statistical models provide a better and more flexible predictor of the correct factor structure.

Fitch applied and analysed a statistical factor model, expressed as:

$$R_{it} = a_{it} + \beta_{i1}F_{1t} + \beta_{i2}F_{2t} + \ldots + \beta_{ik}F_{kt} + \beta_{\varepsilon}\varepsilon_{it}$$

where R_{it} is the return on asset i over period t and F_{kt} are the factors affecting the security return. β_{ik} represents the factor loading, or the change in the return of asset i due to a change in factor k. The residual ε_{it} is that part of the return on asset i that cannot be explained by the other factors and is specific (idiosyncratic risk) to company i.

The Factor model was used to derive factor loadings for all companies included in the Dow Jones Global Universe, which comprised 6,100 companies in 34 countries. These were then grouped into 25 Fitch industries (see page 8). In order to ensure a coherent classification in the future, Fitch has mapped the Dow Jones Global Classification Standard to the 25 Fitch industries, as shown in the Appendix of the Fitch Default Model User Manual.

For each industry-region grouping the average factor loadings as well as the average idiosyncratic exposures were computed. Based on the average exposures, Fitch computed the pair-wise return correlation co-efficient between two entities based on their Fitch industry and region as follows:

$$\rho_{12} = \frac{cov(R_1, R_2)}{\sigma_1 \sigma_2} \text{ where } \operatorname{cov}(R_1, R_2) = \sum_{i=1}^{N-1}\sum_{j=1}^{N-1} \overline{\beta}_{1,i}\overline{\beta}_{2,j} \operatorname{cov}(F_i, F_j) + \overline{\beta}_{1,N}\overline{\beta}_{2,N} \operatorname{cov}(\varepsilon_1, \varepsilon_2)$$

$$\sigma_x = \sqrt{\sum_{i=1}^{N-1} \overline{\beta}_{x,i}^2 \sigma_{F_i}^2 + \overline{\beta}_{x,N}^2 \sigma_{\varepsilon}^2}$$

For example, the correlation between BMW and Boeing would be approximated by the correlation between Central Europe/Automobiles and US Aerospace & Defence using the corresponding factor loadings for these region/industry groupings.

■ Appendix 3

Agenda for On-site Review of Originators, Servicers or Asset Managers

The following agenda outlines the main focus of the on-site reviews conducted by Fitch in an attempt to assess the capabilities of originators, servicers and asset managers. The reviews typically last up to one day. The weight of time spent on each section will depend on the transaction motivation and/or structure, and the party being reviewed.

Company & Management Experience

- Overview of organisational and legal structure
- History & experience
- Strategy and business plan
  - Core/target markets – clients/asset types
  - Initiatives in new markets/asset types
  - CDO investment strategy (personal/company equity ownership)

Financial Condition

- Overview of current financial standing, using audited information
  - Capitalisation
  - Liquidity
  - Profitability
  - Discussion of trends

Staffing

- Staffing summary
  - # of employees by position by department
  - Recruiting/sourcing strategy
  - Incentive compensation structure
  - Staff turnover

Procedures and Controls

- Policies and procedures documentation
  - Investments/credit origination
  - Portfolio management
  - Trading/settlement
  - Portfolio accounting
  - Counterparty risk assessment
  - Recovery process
  - Security valuation
  - Claims processing (credit default swaps)
  - Documentation
- Internal operational audits
- External operational audits

Credit Underwriting/Asset Acquisition

- Investment strategy
  - Targeted portfolio composition
  - Industry preferences
  - Asset class preferences

- Portfolio sourcing
  - Selection of broker/dealers/customers
  - Approved list and watch list review
  - Management of credit limits by counterparty
- Investment selection process
  - Credit research/analysis process
  - Relative value assessment
  - Use of credit ratings
  - External ratings
  - Internal credit rating system
  - Use of external/internal counsel (document review)

Portfolio Management

- Portfolio monitoring
  - Credit monitoring
  - Resources and tools used
  - Marking to market
  - Asset valuation
  - Performance tracking (frequency of reviews)
  - Use of derivatives and hedging

- Management of distressed credits
  - Workout experience
  - Hold or sell decision-making
  - Restructuring
  - Liquidation of security

CDO Administration

- Transaction set-up
  - Documentation review
  - Structural analysis
  - Cash flow modelling/analytics

- Compliance monitoring

- Investor accounting/remitting/reporting
  - Overview of monthly processing cycle procedures
  - Frequency and investor accessibility
  - Problem credits/credit events

- Trustee monitoring
  - Cash management - coordination with trustee
  - Monitoring of trustee record-keeping and reporting

Performance

- Historical default and recovery levels
  - CDO equity returns
  - Migration

Technology

- Summary of current systems
  - Recent enhancements or improvements
  - Planned enhancements or improvements
  - "Key" system(s) demonstration(s)