Risk Information Management for Complex Financial Products

By: Dilip Krishna,
Director, Enterprise
Risk Management and
Capital Markets,
Teradata Corporation

and

Dr. Robert Mark,
Chief Executive Officer,
Black Diamond

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Risk Information Management for Complex Financial Products

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Executive Summary

A comprehensive database of information is required for any organization that holds complex securities such as structured debt. For data to fully serve the needs of risk measurement, they must satisfy the following eight properties: integration, integrity or quality, completeness, accessibility, flexibility, extensibility, timeliness, and traceability.

Most organizations do not have a data environment that can efficiently and effectively handle all these requirements. Data environments historically have not been built from the ground up, but rather, have been developed around the needs of applications designed to serve specific organizational needs such as front office and risk management.

Solutions are, however, currently available to address the problem. This paper shows how these data management technologies and methodologies may be applied to solving the enterprise risk information problem for complex securities.

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Introduction

Financial institutions (FIs) are exposed to various complex risks as a matter of routine in the course of their day-to-day business. For example, Property & Casualty insurance companies are exposed to complicated catastrophic risks in underwriting on the liability side of the balance sheet, as well as a variety of integrated credit and market risks for the portfolio of assets they hold. Banks are also exposed to credit and market risks. Arguably, the real economic function of these FIs is to *get paid to manage and warehouse these risks.*

FIs have focused heavily on managing risk. The best banks have been successful at managing credit risk on a transaction basis. Insurance companies have had many decades of experience in fine-tuning their understanding of a broad variety of underwriting exposures. Yet from time to time, FIs have been hit with large, unanticipated losses – ranging from the demise of Barings (from operational and market risks) to the current fraud and credit issues at Société Générale.

These losses have often mainly come from areas that have not been the core focus of the organization, or have occurred due to a combination of circumstances that required an agility of analysis that was beyond most institutions' capabilities. Nowhere is this more applicable than the current (2007-2008) crisis in the mortgage sector. These losses have led to record write-downs among commercial banks, investment banks, and insurance companies (to date a total of around $319 billion has been written down by all the major players). There are plenty of unanswered questions:

> Why did such outsized losses materialize in the sub-prime mortgage market so suddenly, even though the underlying catalyst – an overheated housing market – had been an area of concern for several prior months?

> Why did the largest and most prestigious financial institutions, which have prided themselves on their significant capabilities and investment in risk management, fall prey in such a public way to these problems?

> Why did some companies issue large restatements in the space of just a few weeks?

> Why did rating agencies abruptly downgrade their credit assessment as opposed to a continuous series of downgrades as a function of the declining credit quality?

> Why did the regulatory community, as well as the legislative and executive branches of government, fail to act in a timely manner to forestall the sub-prime crises?

Another curious aspect of this crisis is that several of the large institutions (UBS[1] and Bank of America[2] to name just two) experienced massive losses originated in businesses that were minor parts of the enterprises. Rating agencies have also been criticized for their role. Some commentators have said the rating industry performed poorly in *calling* the sub-prime crisis (See Figure 1.). Nevertheless, rating agencies, in turn, point to their long-term track record and say that many investors want relatively stable credit ratings, not ratings that jump up and down along with market perceptions. As a result of the criticism, regulatory authorities are conducting a series of investigations into the way the rating industry works.

A closer examination of the sub-prime dynamics reveals several factors that were the primary causes of this loss. Among them are: the complexity and hard-to-value nature of the products in question, significant but hard to discern changes in correlations, a lack of liquidity in the market, and an undue reliance on credit ratings issued by ratings agencies. Large institutions did not have all the necessary data to fully understand these instruments to the extent needed to properly measure their risk.

1 To date (May 2008), UBS has taken about $37 bn of losses against 2007 in its fixed-income business. Fixed-income has hitherto brought in less than a quarter of the company's revenues.

2 Bank of America took a $3 bn write-down in just the 4th quarter in the investment banking unit, which contributes only 20% of the revenue of the bank.

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The scope, complexity, and innovativeness of financial products show no signs of abating. Large FIs cannot hope to drive sustainable profit by steering clear of these products. Rather, they must apply themselves to better understanding and managing the risk of innovative financial contracts to remain competitive over the long term.

A key component of any risk management solution is a robust infrastructure that supports an organization's policies and methodologies. Infrastructure includes the people, processes, and technology needed to implement the methodologies needed and enforce policy. One of the big challenges encountered in infrastructure is the lack of availability of the appropriate data. Data are critical to developing and implementing methodologies especially in the case of complex products such as those referred to here. The availability of good, comprehensive information is also the key to policy enforcement.

This paper discusses issues relating to data in the context of an increasingly complex financial landscape. In these situations, traditional issues of data aggregation are amplified by other unusual issues relating to data. There is little reason to believe that the underlying causes are limited to today's set of financial products. As the financial industry continues to innovate and more closely integrate with various aspects of the economy, the industry must plan to create and manage a robust data infrastructure that is flexible with regard to new requirements being implemented for data analysis.

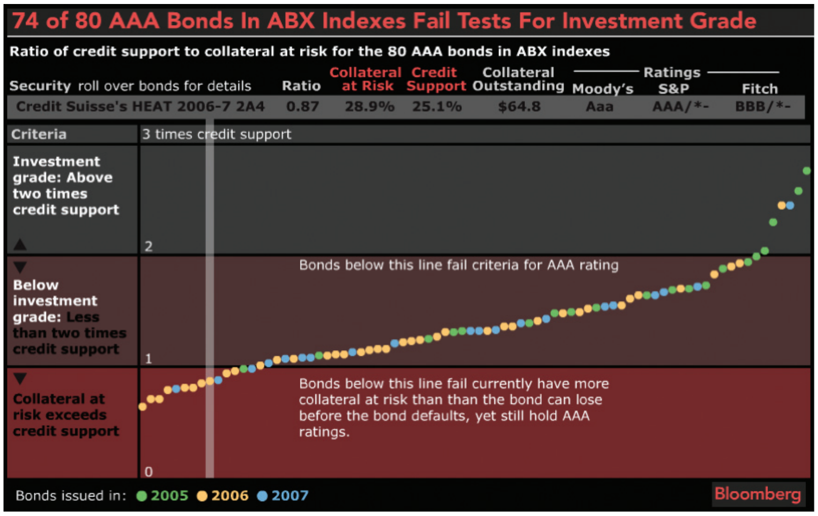

Figure 1. Ratio of credit support to collateral at risk for investment grade bonds. (Source: Bloomberg)

Best-in-class Risk Information Management Systems

Risk information management systems have been a focus at many of the large FIs for several years now. In the banking industry, the Basel II initiative has been a significant catalyst for this focus, and Solvency II promises to do much the same thing for the insurance industry. Several market-related events have also helped focus attention on this problem. Many of the largest banks, for example, had significant issues in reporting their exposures to Enron in early 2002.

These challenges included:

> **Lack of clean data** – The exposure-calculation methodology had already been sufficiently advanced to give a reasonably accurate picture of the organization's overall risk. However, even the best methodologies can be hamstrung by the lack of accurate data.

> **Completeness of information** – It was not easy to ensure that risk calculations had, in fact, taken into account all exposures across the enterprise due to the poor state of information management in most organizations.

> **Lack of timely information** – Risk information was often unavailable until much after the fact, making it less actionable and precise due to the need to address the previous issues by manual data collection and cleansing processes.

Risk Information Management for Complex Financial Products

Large FIs have attempted to improve their information systems to aggregate risk exposures. This effort is driven by an increased need to accurately report risk exposures (e.g., due to the Basel II initiative in the banking industry). Best-in-class systems collect and aggregate all information from across the enterprise and consolidate data at a high-degree of granularity to enable correlation calculations. Such systems enable rapid and timely access to risk measures and ensure that measures are consistent with underlying information. Data have already been reconciled at a granular level with data that are used for financial disclosure. In such a system, it is possible to drill down from high-level risk measures to progressively deeper levels. Drill-down can be effected across several dimensions, such as geography (e.g., region or state), internal organization (e.g., business unit, line of business, branch, or trading desk), product-line (e.g., retail, credit card, mortgages, and commercial loans), and Counterparty (single-name or related entities).

The state-of-the-art system described here is not the norm for most FIs. While many larger banks have been able to accomplish some of the capabilities described above, few have comprehensive aggregation and reporting capability across all lines of business. For example, they may do a good job aggregating exposures across their lines of business, but have little visibility of risk exposures for commercial borrowers who also engage in FX trading activity with the bank. Similarly, while regulatory reporting has made great strides particularly in the large banks due to the rigorous pillar II aspects of Basel II, the ability to compare regulatory and economic capital at a detailed level continues to elude all but the most sophisticated banks.

The insurance industry on the whole lags banking. There has not been the same impetus to consolidate risk reporting within the insurance industry as there was in banks due to Basel II. Large insurance companies are complexes of different legal entities; it has hitherto been difficult to justify the expense of building a system that would, say, integrate exposures between the life insurance operations and the property and casualty (P&C) operations at a granular level. The predominant risks in each type of insurance operation are also quite different. P&C risks typically focus on catastrophic events, while there is considerable market risk in life insurance portfolios (asset-liability mismatch risk, as well as market-related risks arising from products such as variable-annuity contracts).

The pace of innovation in markets continues to outstrip the ability of banks, securities firms, and insurance companies to develop robust infrastructures to meet the challenge. Best-practice risk management requires not only the ability to calculate risk and report on the risk, but also to perform other activities such as stress- and back-testing. A key component of superior risk management is to provide easy access to data and the ability to apply advanced statistical techniques. This is particularly an issue when it comes to understanding the complex risks arising from modern, non-traditional structured products.

Understanding Risks in Non-Traditional Products

The recent mortgage crisis in the U.S. has had a devastating effect on the economic landscape. Large banks such as UBS, Citi, and Bank of America have suffered losses of a scale that have not been seen before. We have seen an initial offer to acquire Bear Stearns by JP Morgan Chase for $2 per share with a follow up offer at $10 per share. (Bear was trading close to $100 only weeks prior.) The central bank created a lending facility for big investment banks to secure short-term loans. The bigger story is that this credit crisis has affected not only banks, but many other companies outside the immediate spectrum – mortgage originators (many of whom, such as New Century Financial and Countrywide Financial, have been extinguished through bankruptcy or takeover), global banks (UBS and Société Générale to name a few), investment banks (e.g., Merrill Lynch, Morgan Stanley, and Lehman Brothers), monoline bond insurers (e.g., AMBAC, MBIA and SCA), insurers (e.g., AIG), and re-insurance companies (such as Swiss Re). The extent of the contagion illustrates a deep interconnectedness in the modern global economy.

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Large-scale losses were experienced in many organizational areas that were decidedly non-core businesses. In some cases, losses arose from a small number of contracts. Swiss Re, the world's largest re-insurer, recorded a CHF 1.2 billion loss *from just two transactions.* The other curious phenomenon in this crisis is the extent to which losses were upwardly restated in the span of just weeks. At Merrill Lynch, for example, losses initially estimated at around $4.5 billion in early October 2007 were upwardly revised *in the space of three weeks* to $7.9 billion.

The reasons for this chaos are still being studied. It is particularly hard to believe that the underlying fundamentals deteriorated in the space of several weeks or months to the extent that these booked losses might indicate. Even though delinquencies and even defaults in the mortgage market were up significantly throughout 2007, they did not show enough of a spike in the fourth quarter of the year to explain the rash of huge write-downs taken by almost every major institution in the marketplace. It seems much more likely that these losses were crude and abrupt adjustments to an underlying economic reality that had been deteriorating for some time.

Certainly the attempt to derive some level of market valuation of mortgage related securities has had a part to play in the re-adjustment. For example, mortgage indices, such as the ABX and ITRAXX, have been cited as the reason, or at least the catalyst, for some of the write-downs. Other observers have described these valuation losses in terms of a lack of liquidity in complex derivative instruments. Managing risk in this context is extraordinarily challenging in an environment where investors have been sufficiently spooked by a whole asset class. The traditional bulwarks of risk management, such as statistical analysis, cannot be the only tools to rely upon in extreme markets since the data required to perform risk analysis in crisis situations are different from normal markets.

The recent history of finance has shown an increasing pace of innovation. New financial products have been designed and marketed at a frantic pace over the past 30 years. The latest trend in financial engineering, which has included Collateralized Debt Obligations (CDOs) and other credit derivatives, has also brought with it new contracts that securitize catastrophic insurance exposure. These new financial contracts are equally, if not more complex than derivatives on mortgages, and would need similar innovative approaches in evaluating risk.

Studying mortgage securities risk is instructive since it enables us to understand how to deal with risks in non-traditional products. The mortgage market in the U.S. is characterized by an intricate linkage of many parties. At the customer end, mortgage originators perform the function of making loans. They are responsible for evaluating default risk of the customer and pricing loans accordingly. Most mortgages are not warehoused by originators themselves, but rather sold to other companies, such as commercial and investment banks, as well as Government Sponsored Enterprises (GSEs), such as Fannie Mae and Freddie Mac. A GSE packages mortgages into mortgage-backed securities (MBS). The GSE then turns around and sells the MBS to a variety of investors, including insurance companies, hedge funds, and banks. In addition, bond insurers also take significant indirect exposures to these securities.

Each of these intermediaries has many interconnected risks to manage. Originators, for example, need to monitor the credit risk of their counterparties. However, they also need to be concerned with funding liquidity risk since there is a time gap between when mortgages are taken on their books and when they are sold to securitizers. If funding liquidity for an originated mortgage dries up after they've been taken on the books, then the consequences can be catastrophic to them. Similarly, other intermediaries have a mix of credit-, liquidity-, model-, and market-risk to measure and manage. Not only is the risk different for each player in the business, but measuring even one of these risks carries with it enormous levels of complexity.

Risk Information Management for Complex Financial Products

Risk measurement of structured credit transactions, such as CDOs, has several layers of structural complexity including:

> Credit- and prepayment-risks in the mortgages at the bottom of the structure.

> Market-, prepayment- and liquidity-risks of the MBS.

> Market- and model-risks, as well as other subtle risks (legal risks and fraud for example) of managed CDO deals.

Price discovery in the CDO market has proven to be fraught with difficulties. CDO indexes, such as the ABX and ITRAXX, do exist but are typically not representative of an institution's portfolio since they represent only a few securities. The ABX contains only 20 deals, for example, also leading to the real possibility of extreme unrepresentative movements. Pricing models[3], on the other hand, require numerous assumptions. Historical data are often not available to validate these assumptions in any meaningful way.

The success of valuation models is generally dependant on two characteristics: the fidelity of the economic theory and mathematics, and the data with which they are provided. The reader is directed to the copious research that has been conducted on the mathematics and economic underpinnings of valuation [7, 8, 9, 10 and 11]. We discuss the subject of data in the next section.

Triangulating to a Risk Measurement

To better understand these new requirements of data infrastructures, a deeper look into valuation is warranted. There are at least four typical ways to measure the risk of these securities: analytical modeling, Monte Carlo Simulation (MCS), use a variety of indices, and stress testing. These techniques can, of course, be supplemented by the use of risk ratings from ratings agencies. Rating agencies are *insiders* (i.e., have access to the internal information of the bank) and are considered to have expertise in credit rating as well as are generally regarded as unbiased evaluators (recent events have, of course, shown that reliance solely on these ratings can be illusory).

A credit rating is not, in general, an investment recommendation concerning a given security since it focuses solely on a security's potential for downside loss without regard to gain. A credit rating is an opinion of the general creditworthiness of an obligor (in its entirety or with respect to a particular debt security or other financial obligation) based on relevant risk factors. In other words, a rating is *an opinion on the future ability and legal obligation of an issuer to make timely payments of principal and interest on a specific fixed-income security.*

Analytic models, such as Moody's popular Binomial Expansion Technique (see [1]) make several simplifying assumptions[4]. This kind of model can be executed quickly with very little underlying information, most of which is available in the prospectus. Models like this have been used extensively by ratings agencies to rate structured products due to their tractability. These models perform adequately during normal economic conditions, but often break down in abnormal markets. For example, correlation calculations have been seen to break down in abnormal markets.

An alternative modeling framework is MCS[5], which should conceptually produce a more accurate loss distribution estimate, but is computer resource intensive, and therefore, often takes a long time to produce accurate results.

Indices are a third way of valuing portfolios. These are a fairly new phenomenon since the first CDS index products were created only in 2001 [2]. Indices such as the Dow Jones iTraxx, which were created in 2004, have experienced a great degree

3 Several models have been developed by ratings agencies and academics to value such securities. Some of these include the Binomial Expansion Technique (BET), Fast Fourier Transform algorithm (FFT), copula approaches developed by S&P and CreditMetrics. Refinements and new models continue to be developed. The rich state of model development in this field suggests a lack of consensus approach to pricing.

4 Basically BET calculates a diversification score for the portfolio and replaces the actual portfolio with a much simpler hypothetical portfolio of homogeneous, uncorrelated securities.

5 The main inputs in the Monte Carlo simulation approach are asset-level probabilities of default and pair-wise asset correlations, which are turned into an estimate of the entire collateral pool's loss distribution.

of popularity in the past few years that has paralleled the growth in the CDO markets. These CDS indices allow buyers and sellers to acquire or sell exposure to different segments of the credit curve and insulate exposure to interest rate movements that would ordinarily accompany a similar cash investment. The illiquidity of these indices has been their undoing in recent months. They have also proven unrepresentative of most structured portfolios.

Stress testing has become increasingly important due to the spreading credit market dislocation. Stress testing evaluates the potential impact on portfolio values of unlikely, but plausible events. It is an important adjunct to the models previously described since it can identify risk in extreme scenarios where other models may break down. In addition, it may help identify model risk (risk of undue reliance is placed on a particular model). Increasingly, bottom-up stress testing is becoming popular, where individual units within the portfolio are subject to stress factors. For example, loan level factors, such as loan, borrower, and collateral risk characteristics, are taken into account. In addition, interactions between loan level factors and borrower behavior, such as incentive to refinance, may be explicitly modeled.

The methods described above pertain to mortgage-backed securities, but there is critical information that can be gained from studying the underlying mortgages as well. There is a level of certainty associated with the horizon value for fixed-income securities. The horizon value for mortgages, though less certain, can still be estimated with knowledge of historical probabilities of default (PD), loss given default (LGD) and other factors, such as portfolio seasoning. The ability to make loan level estimations could act as an important sanity check to the fidelity of the other valuation methods described above.

It is clear that each of the valuation techniques discussed above has strengths and weaknesses. Given the current state of first-generation models, it is not possible to rely on any one of these methods. Valuation and risk measurement of portfolios of complex products, therefore, should involve using *all* these above sources of information and *triangulating* to a result (See Figure 2.).

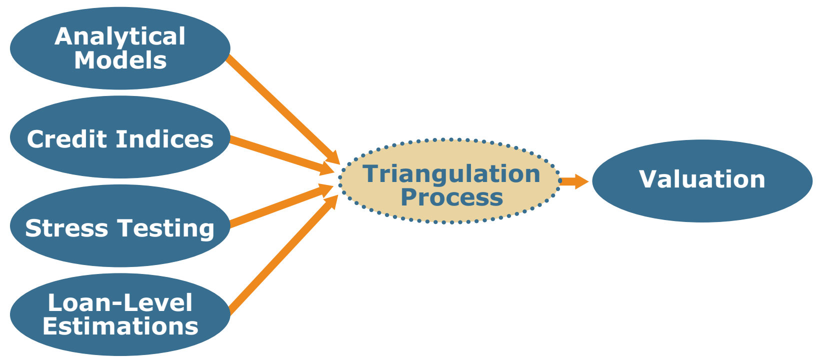

Figure 2. Triangulating using different methods of valuation.

Model Accuracy and Data

The accuracy of models depends on the following factors:

> **The validity of the model itself** – Does the model adequately account for all important economic phenomena?

> **Robustness of input parameters** – Estimating parameters such as correlation, PD, and LGD based on a sufficient, detailed set of data are critical to a model's accuracy – parameters generated by a significant amount of data gathered across different economic scenarios (say over a business cycle) are best.

> **Data input into the model** – It is critical to have complete, accurate data about current outstanding exposures so that model results can be accurate.

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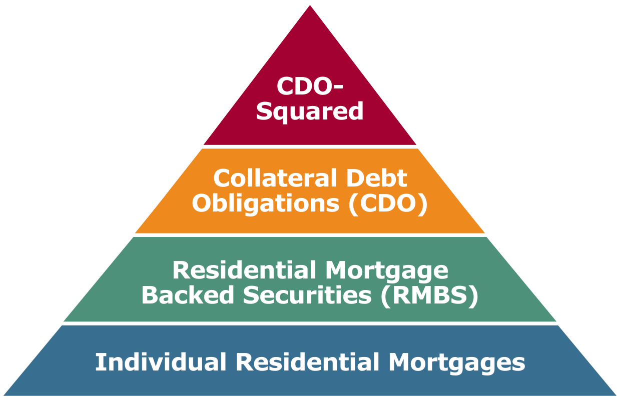

Figure 3. Data complexity in structured mortgage products.

Superior modeling approaches use well-designed techniques to model the behavior of the underlying factors based on available data. A model for complex structured products, such as CDOs, would need as inputs not only the characteristic of the structured security, but also the underlying portfolio of mortgage-backed bonds. A dynamic, changing portfolio like a market-value CDO would add the additional complexity of maintaining the history of bond positions within the CDO. One would have to go one level deeper and understand the characteristics of underlying mortgages themselves to capture all the possible effects on the ultimate product.

Being able to achieve such a level of understanding relies on the availability of data. Structured products have a plethora of data relationships that must be captured to properly feed models that value them. Figure 3 illustrates this complexity.

At the bottom of the pyramid are thousands of mortgages that are pooled and tranched into Residential Mortgage-Backed Securities (RBMS). Individual tranches are then combined into CDOs, which are also tranched. In some cases "inside-CDOs" or "CDO-squared" securities are created, which contain tranches of CDOs. This pyramidal structure was designed to diversify risk – which seems reasonable at first blush. For example, if RMBSs are pooled from different geographical concentrations, and subsequently combined into a CDO, then conceivably the total risk of the structure could be lower than the risk of any one security due to diversification effects. However, a well-known result is that diversification effects tend to disappear in distressed markets (i.e., correlations tend to converge to one). Stress testing a CDO requires understanding the characteristics of the CDO, as well as its underlying RMBS tranches and the mortgage characteristics that underlie the pools.

The data for the model must be both detailed and highly granular. For example, each mortgage must have details such as loan-to-value ratio, debt-to-income ratio, and appraisal type. Likewise RMBSs and CDOs must have the same level of detail. Data must also contain all the attributes necessary to fully understand the risk. The availability of such detailed data is critical. Some notable FIs with large mortgage businesses in the U.S., with well-developed infrastructures that enabled them to capture the relevant data, avoided direct sub-prime originations precisely because they understood the weaknesses that result from the lack of data that characterized that market. These FIs were subsequently spared the effects of direct exposure to deteriorating loans of this type, though some did experience large write-downs in indirect mortgage exposure through structured products.

An additional complication is the need to understand linkages between different components in this structure. For example, it is critical to understand which mortgages are included in a particular RMBS structure. It is also important to understand linkages between securities. For example, it would be useful to know that two CDO structures are being managed by the same manager.

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The Risk Information Problem

To understand this problem better, let us consider the example of a plain vanilla Collateralized Loan Obligation (CLO) in Figure 4.

There are only three tranches of securities in Figure 4 that are supported by collateral in the form of 50 diversified corporate loans. The equity tranche is in the first-loss position, does not pay any promised payment and absorbs default losses before they reach the senior investors[6].

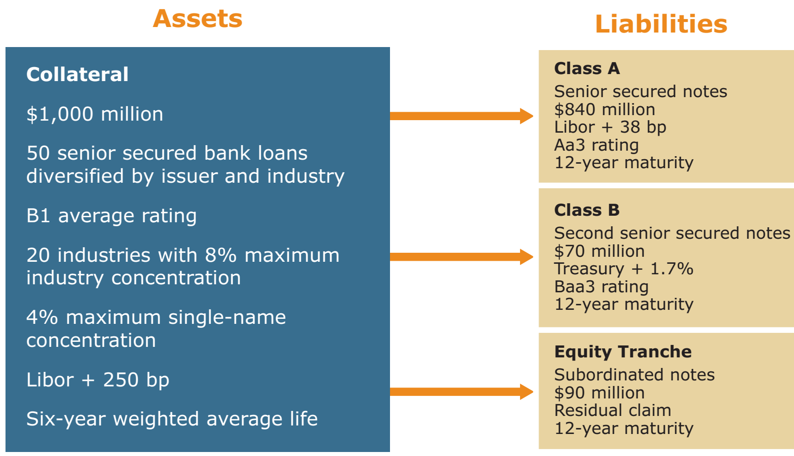

Figure 4. Example of a collateralized loan obligation [3].

There is a rich milieu of data relationships that must be captured to properly estimate the risk inherent in the CDO structure even in this plain vanilla example. First, the various loans must be recorded along with their details, such as obligor and loan size (authorized, outstanding). The relevant industry attributes for each loan must be recorded to ensure that the loans are properly diversified. One would also need to compare these obligors against a hierarchy of legal entities to ensure that there were no direct ownership or dependant relationships between them. One also needs to capture the myriad other details of this structure, including the various tranches (e.g., the attachment and detachment points) and other agreements, such as interest-rate swaps that the Special Purpose Vehicle (SPV) may have entered into. Any credit enhancements would also be of interest. An institution holding bonds issued by this SPV must record this detail for securities from all other SPVs in its portfolio since the same obligors could be part of several SPV structures.

These data would require a complex database of information for any organization that holds a reasonable amount of structured debt. For data to fully serve the needs of risk measurement, they must satisfy the following eight properties:

Integration

As described above, all relevant relationships between data elements must be adequately captured across the organization.

For example, in a structured security, do all insurer-wrapped tranches have information about the monoline insurer? Does this information link to information about the insurer itself, including current ratings information?

Integrity

Integrity of data is essential in ensuring the confidence in risk measurements.

Are all data elements of sufficient quality with valid dates, for example? A simple quality check might be to ensure that trade dates always precede settlement dates.

Completeness

All exposures across the organization must be captured, including bespoke deals that are held ad hoc on traders' spreadsheets.

Accessibility

Users must have easy access to current and historical data to perform any analyses they require.

6 In our example, the senior class A note is rated Aa3 and pays a coupon of Libor + 38 basis points. The second senior secured mezzanine tranche is rated Baa3 and pays a fixed coupon of Treasury + 1.7 percent for 12 years. The rating enhancement for the two senior classes is obtained by prioritizing the cash flows.

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Accessibility includes being able to extract and reuse data in any form users require (within limits set by security and other requirements).

Flexibility

Users can analyze data across any dimension they choose.

Data flexibility includes being able to filter or summarize information in any dimension, rapidly and at will. This is especially critical in a test-and-learn environment necessary in valuing complex structured products. For example, summarizing data by credit rating and geography may lead to an insight that further drill-down by weighted- average maturity would be useful. The ability to rapidly access successive layers of information is crucial to effective analysis.

Extensibility

New types of data required for analyses must be easily integrated into the overall data environment.

As mentioned earlier, one of the primary problems of valuing complex instruments is that it is often necessary to include new types of data. Extensibility refers to the ability to bring this data into the environment along with all relevant linkages and the appropriate level of data quality.

Timeliness

Data are available soon after the occurrence of the relevant business event. The value of timeliness can easily be understood in the stock markets, where real-time information (available in milliseconds after prices are made) is worth many hundreds or thousands of dollars per month, while information that is 15 minutes delayed is available for free on web-sites such as Yahoo and Google.

In an environment where market information has immediate and significant impacts, it is important to ensure access to the latest information. This pertains to market data, deal information, and revaluations, as well as the latest news from the market.

Data Management Dimensions Defined

- **Business Governance** – Including analytic requirements, funding of data initiatives, program management discipline, prioritization, and measurement of return on investment of data initiatives. Governance provides crucial management support and focus to the data environment.
- **Architecture** – Aspects such as design of data and analytical architecture, selection of data platform.
- **Workload Profile** – Creation of Analytical Output, Interactions with External Systems, Service Level Agreements, and System Management. These issues are crucial to ensure an environment that is responsive to diverse needs such as modeling, reporting, and stress testing.
- **User Access** – Tools used for access, as well as security and privacy considerations.
- **Decision Support** – Availability of data and analytical capability to support specific requirements (e.g., are sufficient data elements – such as debt-to-income, appraisal type, originating lender – available to properly model mortgage default and loss?).
- **Data Management** – What business processes govern aspects such as Metadata, Master Data, Data Quality, Data Privacy, and Security?
- **Data Integration** – The Strategy, Technology, and Data Currency required for data integration.
- **Business Continuity** – The availability, recoverability, and protection of data within the environment.
- **Communications and Training** – Communications, Internal Marketing, Training, and Support regarding the data environment.

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Traceability

Data are easily traceable from reports back to their source.

Data that are not verifiably correct cannot be relied upon. If there is a possibility that data could have been modified without traceability, there will always be diminished confidence in any numbers that result from that data. In an environment of increased scrutiny and transparency, the ability to prove that data was not maliciously or inadvertently tampered with is paramount.

Most organizations do not have a data environment that can efficiently and effectively handle all these requirements. Data environments historically have not been built from the ground up, but rather, have been developed around the needs of applications designed to serve specific organizational needs such as front-office and risk management. Data environments developed in this manner rarely, if ever, satisfy all the criteria mentioned above.

To solve the problem, a four-step approach is called for:

1. Assess the current data environment.
2. Design a future-state data environment given the requirements mentioned above, and identify gaps between current and future state.
3. Develop a future-state implementation roadmap.
4. Implement the roadmap in incremental steps that generate value at each stage.

We will next discuss the first step, and leave steps two through four for future papers.

Assessing the Current Data Environment

The current state of the data environment must be assessed in a comprehensive manner. The organizational aspects of data management must be considered [see page 6 for details] as well as the technology and data flow underpinnings within the organization. A number of dimensions must be explored including Business Governance, Architecture, Workload Profile, User Access, Decision Support, Data Management, Data Integration, Business Continuity, Communications, and Training (see callout for definitions).

A comprehensive understanding of the environment's current state can be attained once these dimensions are assessed at a further level of detail. If we incorporate an understanding of the goal state of information usage a high-level map can be created (an excerpt is shown in Figure 5. This map shows the current rank of the organization along various dimensions (actually sub-dimensions to the main categories described above) along a 0-5 scale with 5 denoting the highest level of competency. The diagram also shows the target rank that the organization desires to achieve. It is interesting to note that the target rank is, in most cases, not 5. Achieving perfection is usually not a cost-effective solution; rather it is important for the organization to calibrate its data management needs to business requirements.

Dimension	Priority	Current Ranking	Goal State	Operate 0	Understand 1	Change 2	Grow 3	Compete 4	Lead 5
1. Corporate Maturity									
1. Business Focus	High	4.00	4.00						
2. Business Governance									
2. Analytic Requirements	High	3.00	4.00						
3. Funding Limitations	High	3.00	4.00						
4. Prioritization of Initiatives	High	3.00	4.00						
5. Measurement of ROI	High	1.00	4.00						
3. Architectural Governance									
6. Data and Analytical Architecture	Medium	2.50	4.00						
7. Platform and Database Selections	Low	2.00	3.00						

● Current Rank Below Target ◆ Current Rank Equal Target ▶ Target Rank

Figure 5. Map of data management maturity.

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	Inadequate	Basic	Adequate	Satisfactory	Progressive	Comp Edge
Integration		RAPM RBP AML	Basel II Fraud Econ Cap	*Reg Cap*	*Stress Test* *Disclosure*	
Integrity		RAPM	Reg Cap Econ Cap	*Disclosure* *AML* *RBP*	*Fraud* *Basel II*	*Stress Test*
Completeness		RAPM	AML	*Reg Cap* *Econ Cap* *RBP*	*Basel II* *Fraud* *Stress Test*	*Disclosure*
Accessibility		RAPM Basel II	RBP Stress Test Econ Cap	*Reg Cap* *AML*	*Stress Test* *Disclosure*	
Flexibility and Extensibility	Stress Test AML	Stress Test Disclosure	RAPM RBP	*Reg Cap* Econ Cap	*Basel II*	
Timeliness	Basel II	RAPM RBP	Fraud Econ Cap	*Disclosure* *Reg Cap*	*Stress Test*	*AML*
Auditability (Traceability)	RAPM	AML	Reg Cap Econ Cap RBP	*Basel II* *Fraud*	*Stress Test* *Disclosure*	

Needs Significant Improvement   Needs Improvement   *Meets Objectives*

Figure 6. Assessing business needs for information management (acronyms described in Footnote 7).

Calibrating business requirements with data requirements calls for segmenting business functions in an appropriate manner. Each function can be assessed along the information management dimensions discussed earlier. The result is shown in Figure 6 for an illustrative commercial bank.

If the priorities for specific aspects of the data management environment are well-understood, and gaps have been identified, then it becomes possible to address these in a structured manner via a series of initiatives. These initiatives can then be executed according to well-known project management principles.

Conclusion

FIs have built solid business relationships over the years with their clients through lending and other services. They also have highly complex back offices to facilitate the servicing of these credits, and have developed a network to distribute financial assets to retail and institutional investors either directly or through structured products. However, the recent crisis has shown that there is still a huge gap in the risk management and valuation aspects, especially in the complex financial products business. A finely tuned approach to risk information management is a critical component of superior risk management. This calls for managing data on an integrated and value added basis,

7 The terms in the diagram deserve explanation. RAPM stands for Risk Adjusted Performance Measurement, RBP refers to Risk-Based Pricing, AML stands for Anti-Money Laundering regulations. Econ Cap refers to Economic Capital while Reg Cap is shorthand for Regulatory Capital.

as well as to create an environment that supports flexible, granular assessment of data. Data environments in most FIs do not measure up against these standards. These standards are definitely achievable given the current state of data management technology and practice. A necessary condition for superior data management calls for a willingness to focus and invest resources on upgrading the quality of risk information management.

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About the Authors

Dilip Krishna, CFA FRM

Dilip Krishna is head of the Teradata Enterprise Risk Management and Capital Markets practice in North America. He and his team have consulted about enterprise risk management and Basel II initiatives with several U.S. financial corporations. He has had 15 years of experience in technology and business consulting in the financial industry and brings significant experience in the successful management of large-scale projects. He has authored numerous articles about risk data architecture and implementations and has also spoken on the topic in diverse settings. He holds CFA and FRM designations, as well as engineering degrees from the Ohio State University and the Indian Institute of Technology.

Dr. Robert M. Mark

Dr. Robert Mark is the Chief Executive Officer of Black Diamond, which provides corporate governance, risk management consulting, and transaction services. He serves on several Boards. In 1998, he was awarded the Financial Risk Manager of the Year by the Global Association of Risk Professionals (GARP). He is on the board and is the Vice Chairman of The Professional Risk Managers' International Association (PRMIA). Prior to his current position, he was the Senior Executive Vice President and Chief Risk Officer, as well as Corporate Treasurer, at the Canadian Imperial Bank of Commerce (CIBC). Prior to CIBC, he was the partner in charge of the Financial Risk Management Consulting practice at Coopers & Lybrand. He earned his Ph.D., with a dissertation in options pricing, from New York University's Graduate School of Engineering and Science, graduating first in his class. Subsequently, he received an Advanced Professional Certificate (APC) in accounting from NYU's Stern Graduate School of Business, and is a graduate of the Harvard Business School Advanced Management Program.

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