

Kamakura
Corporation

KAMAKURA

ON-LINE PROCESSING SERVICES
OUTSOURCED VALUATION AND RISK ANALYSIS

Kamakura Risk Manager

Version 7.1

ALM

Credit Risk

Market Risk

Basel II

FAS 157 and FAS 133 Integrated Risk Analysis

— MARCH 2009 —

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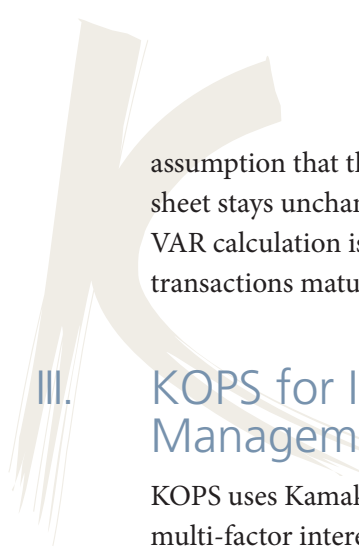
I. Introduction

In response to the credit crisis which began in 2007, U.S. bank regulators imposed a “stress testing” requirement on the top 19 banks in the United States in March 2009. The largest banks in the country were required to stress test the valuation and loss experience of every asset on the balance sheet with respect to a base case and adverse scenario for real gross domestic product, the unemployment rate, and home prices, the macro factor many feel is the driving factor in the crisis. Many of the largest banks in the United States found that their legacy risk systems were unable to perform this analysis. Instead they turned to the Kamakura On-Line Processing Services (“KOPS”) for the full range of risk analysis: asset and liability management, credit risk analysis, valuations for Financial Accounting Standard 157 and 133, market risk calculations, Basel II calculations, liquidity risk analysis, and many other related calculations. In August, 2007, major institutions that purchased the bonds and commercial paper of structured investment vehicles once rated AAA called on the KOPS service for valuations immediately before and after the collapse of these SIVs. This brochure summarizes the valuation and related analyses available under the KOPS service. For more detailed information on the system Kamakura uses for KOPS, please see the companion brochure “KRM in Depth” on the Kamakura Web site www.kamakuraco.com.

II. Risk Analysis in the Credit Crisis

The KOPS service using the Kamakura Risk Manager system provides risk managers, senior management, the Board of Directors, shareholders, and regulators with the capability to explicitly analyze the total risk impact of macro-economic factors like home prices, interest rates, foreign exchange rates, stock prices, oil prices, commercial real estate, and commodity prices. Kamakura Risk Manager is designed to operate at any level of granularity in portfolio data, but the “best practice” users of KRM use the most detailed portfolio data possible: loan and transaction level data. The KOPS analysis can employ whatever granularity of data is available to the KOPS client. Kamakura’s view is that a clear understanding of total risk can only be obtained by assembling the total risk of the institution, transaction by transaction. This is what the KOPS service using KRM is designed to do when such transparency is available to our clients.

Bloomberg.com reported on January 28, 2008 that Merrill Lynch’s value at risk was calculated at \$92 million compared to actual losses from the credit crisis of \$18 billion, 200 times larger than measured risk levels. KOPS and Kamakura Risk Manager include the traditional value at risk calculations, both historical VAR and variance-covariance based value at risk, but KRM also includes important extensions to the concept to avoid the kind of risk measurement errors that Merrill Lynch experienced. KOPS using KRM includes a full multi-period value at risk calculation that allows for dynamic changes in portfolio or balance sheet composition and VAR on a fully default adjusted basis. Cash flows are re-invested, options are exercised, and so on. Standard VAR and credit VAR make an unrealistic



assumption that there is only one time period in the analysis and that the beginning balance sheet stays unchanged. Users have this option in KRM but the best practice multi-period VAR calculation is much more realistic, because the balance sheet evolves over time as some transactions mature and new transactions are added in a predictable fashion.

III. KOPS for Interest Rate Risk and Asset and Liability Management

KOPS uses Kamakura Risk Manager's powerful ALM capabilities including client-defined multi-factor interest rate models, multiple approaches to prepayment analysis including state of the art logistic probabilities of prepayment, dynamic movements in new business, state of the art options models consistent with the work of Professor Robert Jarrow, and modern valuation techniques for valuing complex assets and liabilities like life insurance policies, bank owned life insurance, non-maturity deposits, servicing rights, and so on. KOPS analytical features using KRM include the following:

- **KRM Data:** Either transaction level data (best practice) or summarized data
- **KRM Term Structure Models:** N-factor term structure models (up to 999 factors) can be defined by the user
- **KRM Fixed Income Options:** Closed form solutions, lattice solutions, and monte carlo solutions are available
- **KRM Prepayment Models:** Logistic prepayment (KRM version 7.2), prepayment functions, prepayment tables, and a wide range of prepayment speed models
- **KRM Options Exercise:** Fixed income options can be exercised rationally or "irrationally" subject to transactions costs to be mimic actual consumer behavior
- **KRM Non-Maturity Deposit Modeling:** Modeling can be done either using the no-arbitrage approach of Jarrow-van Deventer (1996, 1998) or by using specific user defined formulas for rate and balance evolution as a function of interest rates
- **KRM Default Modeling:** KRM ALM analysis can use a wide range of default models as outlined below in the KRM for credit risk section
- **KRM Yield Curve Smoothing:** KRM provides the user with the choice of six yield curve smoothing methods and six credit spread methods for fitting current market yield curves. Among the choices are the maximum smoothness forward rate method of Adams and van Deventer (1993).
- **KRM Yield Data Format:** KRM accommodates a wide array of interest rate data formats from raw bond prices to common libor and swap market conventions
- **KRM Roll-over and New Business Modeling:** KRM allows dynamic balance sheet evolution using a rich array of user choices regarding the investment of scheduled and unscheduled cash flows, the amount and nature of new business, and the dynamic evolution of deposit balances.
- **KRM Matched Maturity Margin Simulation:** As noted in the next section, KRM can simulate net income on both a gross basis and a matched maturity basis, recognizing the transfer pricing strategy followed by the institution.

IV. KOPS for Transfer Pricing and Performance Measurement

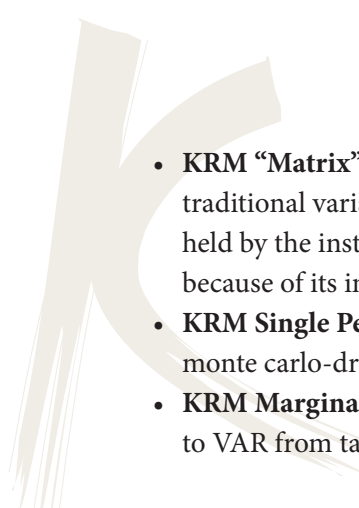
As Kamakura's van Deventer, Imai and Mesler noted in their 2004 book *Advanced Financial Risk Management*, performance measurement and transfer pricing have changed enormously since Wm. Mack Terry and his team at Bank of America invented the transfer pricing concept at Bank of America in 1973. KOPS using Kamakura Risk Manager uses the exact date of cash flow, adjusted for holidays, weekends, business day conventions and so on, to assign a cost of funds to each asset and a credit for funds for each liability. KOPS using KRM for transfer pricing has the following features:

- **KRM Transfer Pricing Techniques:** KRM allows the user to select from multiple transfer pricing techniques. The best practice technique is an exact day count matched maturity funds transfer pricing cost based on current yield curves using one of the yield curve smoothing techniques outlined in the KRM for interest Rate Risk Management Section. Other techniques include transfer pricing based on constant duration or weighted average interest rate approaches.
- **KRM Transfer Pricing for Historical Data:** Transfer prices can be “recreated” on historical yield curve data and assets originated in the past by applying the technique selected by the user to data which existed at the historical point in time.
- **KRM Simulation of Transfer Pricing Margins:** KRM can simulate net income forward on both a traditional basis and on a transfer pricing basis, allowing the user to see clearly how much of the variation in net interest income is due to funding mismatches and how much is due to a matched maturity funding strategy.

V. KOPS for Market Risk

As noted above, KOPS and Kamakura Risk Manager include both traditional approaches to value at risk and credit adjusted value at risk and a much more modern approach: a dynamic multi-period credit-adjusted value at risk. This flexibility allows market risk managers to replicate legacy systems while moving forward to a more modern approach that allows multiple VAR horizons and an analysis period as far beyond the traditional 10-day VAR calculation as the user thinks is appropriate. Many KRM users, for example, look at VAR analysis where the time horizon is many years.

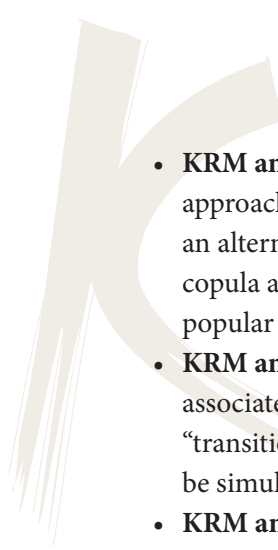
- **KRM Multi-period Dynamic VAR:** KRM employs the asset and liability market practice of dynamic balance sheet modeling and monte carlo simulation to generate a dynamic multi-period value at risk that recognizes both portfolio evolution and the potential default of counterparties. Many Kamakura clients regard this as the best practice VAR calculation.
- **KRM Historical VAR:** KRM also calculates traditional historical value at risk based on historical movements in the yields on securities currently held by the institution. This common calculation, of course, will only be correct if the future has the same risk characteristics of the historical period used for modeling. Historical VAR can be calculated either using relative changes in asset prices (percentage changes) or absolute changes in asset prices (i.e. the dollar, yen or Euro change in price).

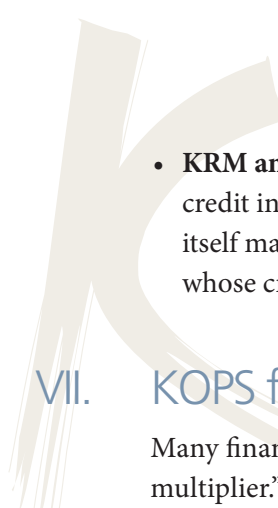
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- **KRM “Matrix” or Variance-Covariance VAR:** KRM also includes the selection of the traditional variance-covariance approach to VAR, which assumes that returns on assets held by the institution are normally distributed. This common calculation understates risk because of its implicit assumption that default will not occur.
 - **KRM Single Period Monte Carlo Simulation VAR:** KRM can be used for a single period monte carlo-driven value at risk in addition to the multi-period approach outlined above.
 - **KRM Marginal VAR:** KRM Version 7.1 includes the output of the marginal contribution to VAR from taking an additional dollar of exposure to a particular asset or liability.

VI. KOPS for Credit Risk and Credit Portfolio Management

KOPS using Kamakura Risk Manager provides credit risk managers with a steady way forward from traditional reliance on internal and external ratings to a full multi-period macro-factor driven simulation where default probabilities for all counterparties (from retail to small business to listed companies to sovereigns) rise and fall with the economy. It is the latter approach that provides true “see through” risk assessments of exposure to macro factors like home prices, avoiding the losses that Merrill Lynch and UBS incurred because of the lack of transparency in macro-factor risk. KOPS clients can derive “delta hedges” on total portfolios and full balance sheets for each macro factor. KOPS using Kamakura Risk Manager allows the use of internal ratings, internal default models, third party ratings and default models, and the Kamakura Risk Information Services public firm and sovereign default models. KOPS clients have the following features at their disposal:

- **KRM Logistic Default Models:** KRM can use user-defined or third party default models based on logistic regression and user-defined variables to simulate default/no default on a multi-period basis for retail, small business, corporate, and sovereign counterparties. Because this approach allows the explicit incorporation of macro-factors like home prices, oil prices, interest rates, and so on, many KRM users regard this approach as the only methodology which would have allowed the losses of the 2007-2008 credit crisis to be avoided.
- **KRM and Logistic Regression:** KRM has the logistic regression calculation built in, so that users with particularly large modeling data bases can employ the powerful relational data base management capability in KRM for maximum modeling accuracy. Common statistical packages rely heavily on text files for inputs and have a relatively small tolerance for large data sets, so the KRM logistic regression calculation is an attractive alternative. If logistic regression models are derived outside of KRM, their coefficients are simply loaded into KRM for simulation of forward default probabilities.
- **KRM and KRIS Default Models:** KRM can seamlessly load and use the corporate and sovereign default probabilities that Kamakura provides as part of its Kamakura Risk Information Services default probability service. The KRIS service also includes the correlation between default probabilities for any pair of companies of the 20,000 global companies covered by the KRIS service.

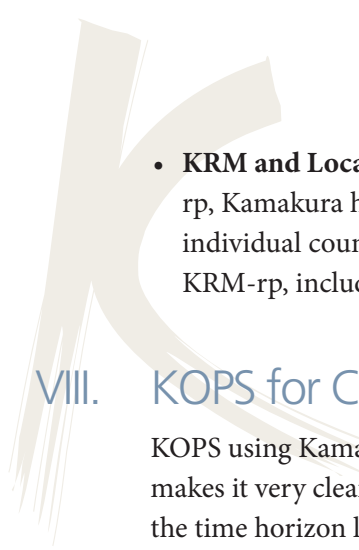
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- **KRM and Merton/Copula Default Models:** KRM can also use the traditional Merton approach to risky debt and the related copula approach to simulate default/no default as an alternative to the logistic regression approach. Although many analysts have cited the copula approach as a contributor to valuation errors in the current crisis, it remains a popular modeling choice among market participants.
 - **KRM and Internal Ratings:** KRM allows internal ratings and the default probabilities associated with the ratings to be simulated forward. From the evolution of the ratings “transition matrix,” default probabilities and credit spreads of all classes of borrowers can be simulated forward. This is also a popular choice among market participants.
 - **KRM and Rating Agency Ratings:** KRM also allows third party rating agency ratings and transition matrices to be used to simulate default and credit spreads on a forward-looking basis.
 - **KRM and Third Party Default Probabilities:** KRM allows the user to supply KRM with default probabilities from any source, whether they be from internal models or from third party vendors.
 - **KRM and Loss Given Default Derived from Collateral Values:** KRM provides the user with many choices for modeling loss given default. The best practice technique, in the view of many KRM users, is to allow the user to specify how the collateral underlying the loan (say the home price or automobile price) evolves in response to changes in other macro factors. In a default scenario, KRM takes the collateral value for that loan in that point of time in the given scenario and then assumes the collateral is liquidated subject to transactions costs with a user-specified time lag from the event of default. This approach can be used even for unsecured debt instruments by modeling the “value of company assets” in the Merton style as effective collateral.
 - **KRM and Random Loss Given Default:** Loss given default or the recovery rate can also be modeling in KRM as a random risk factor without modeling collateral explicitly.
 - **KRM and Exposure at Default:** Basel II requires a detailed analysis of the potential exposure at default of many classes of credits. The exposure at default will be random if the transaction allows for prepayment (a “call” by the issuer of the debt) or additional drawdown (a “put” of the debt instrument to the lender by the borrower). KRM includes embedded rational and “irrational” exercise of these options by all classes of borrower so that the exposure at default is calculated in a very realistic way.
 - **KRM and Credit Default Swaps:** KRM includes valuation, cash flow generation, and financial accrual calculations for credit default swaps and a very wide array of other credit risky instruments.
 - **KRM and Collateralized Debt Obligations:** KRM includes the capability to model both “cash flow” and “synthetic” collateralized debt obligations down to the individual collateral level. KRM also has links to the Intex CDO libraries for automated access to the waterfalls on individual CDO deals. For CDO transactions that are new or are not included in the Intex libraries, users can overlay their own waterfalls on the transaction level cash flow generated by KRM to obtain realistic cash flows and valuations for a particular tranche and waterfall structure.

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- **KRM and Guarantees:** KRM allows the user to analyze the guarantee or “wrap” of a given credit instrument as a separate and distinct transaction, recognizing that the guarantor itself may default in a way that is correlated with the default of the underlying borrower whose credit has been guaranteed.

VII. KOPS for Basel II Capital Calculations

Many financial institutions have learned that Basel II requires more than a “risk weight multiplier.” The Capital Accords from the Basel Committee on Banking Supervision incorporate a complex set of rules as to what risk weight should be assigned to a particular asset. KOPS using Kamakura Risk Manager includes the full set of rules to make these calculations in a very efficient and accurate manner. Kamakura and its distributors have installed KRM for Basel II purposes from Warsaw to Hong Kong, with the appropriate modifications through the KRM-rp web based reports portal for unique national Basel II implementations. Besides the Basel II calculations within Kamakura Risk Manager, Kamakura’s risk experts provide advisory services to clients around the world on credit modeling, Basel II-compliant model audits, and other key Basel II-related topics. Version 7.1 of KRM includes several updates to enable expeditious implementation of the Basel Standardized approach, as outlined in the Capital Requirements Directive (CRD) and the Prudential Sourcebook for banks, building societies and investment firms (BIPRU). KRM-rp’s Basel II reports adhere to the Common Reporting Standards (COREP) specified for Basel II. KOPS for Basel II includes the following features:

- **KRM for Simulating Basel II Capital Ratios Forward:** KRM is much more than a simple report on Basel II capital ratios at the current point of time. The full power of KRM interest rate and credit simulation capabilities can be used to simulate Basel II capital ratios forward in time on a realistic basis so that management gets maximum early warning of potential regulatory capital shortfalls.
- **KRM for Standard Basel II Capital Ratios:** KRM calculates the standard Basel II capital ratios as part of the normal “mark to market” calculation in KRM.
- **KRM for the Advanced Internal Ratings Based Basel II Calculations:** KRM’s powerful credit risk modeling capabilities make KRM the ideal vehicle for institutions pursuing the “Advanced IRB” approach to Basel II. From model building to exposure at default simulation, KRM has the richness to produce Basel Capital Ratios with maximum accuracy.
- **KRM and Kamakura Consulting for Basel II:** From Hong Kong to Warsaw, Kamakura has consulted with the modeling and risk management teams of some of the world’s most sophisticated financial institutions on a number of Basel II techniques: default model construction, model audits and measures of model accuracy, linking internal ratings to default probabilities, linking third party ratings to default probabilities, linking credit scores to default probabilities, and insuring that the business cycle and macro-economic factors are properly linked to default probabilities in order to create realistic evolution of default probabilities at every point in the business cycle.

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- **KRM and Local Basel II Rules and Reporting:** Using the web-based reports of KRM-rp, Kamakura has worked with clients all over the world to insure that differences in individual country Basel II calculations and reporting formats are correctly produced in KRM-rp, including local language reporting.

VIII. KOPS for Capital Allocation

KOPS using Kamakura Risk Manager's dynamic balance sheet simulation capabilities makes it very clear that capital requirements have a term structure. Capital needs grow as the time horizon lengthens and when the business cycle turns down. Kamakura's multi-period simulation show the period by period picture of that capital needed to achieve a target institutional rating, default probability and likelihood of survival. Stress testing of economic capital in Kamakura Risk Manager demonstrates clearly that macro-economic factors like interest rates, home prices, oil prices, stock market prices, foreign exchange rates, and commercial real estate prices impact capital requirements. KOPS using KRM has the following features:

- **KRM Dynamic Multi-period Credit-Adjusted Capital Simulation:** As noted in the asset and liability management and credit risk sections above, KRM allows users to simulate capital needs for an institution that recognize cyclical default probabilities, cash flow reinvestment, and the sensitivity of liability suppliers to the credit risk of the institution. See the section below for more in that regard. The result of these powerful capabilities is a realistic term structure of capital needs of unsurpassed accuracy. Many KRM users regard this approach as the best practice calculation for capital requirements.
- **KRM Single Period Credit-Adjusted VAR for Capital Allocation:** Many institutions have a capital allocation policy that is based on a single period credit adjusted value at risk calculation. KRM provides this special case in addition to the multi-period approach outlined above.
- **KRM Capital Allocation at the Transaction Level:** KRM can calculate transaction-level capital requirements in two ways. The first way is via the sophisticated monte carlo simulation techniques above, where the nth percentile transaction value determines the capital required in accordance with the policy of the institution doing the analysis. The second way is more general. In many institutions, the capital required often includes considerations above and beyond the monte carlo outputs. For institutions with this kind of capital allocation policy, KRM takes the user-supplied capital allocation formula and applies this formula to each individual transaction to get required capital.
- **KRM Calculation of the Institution's Own "Inside Out" Default Probability:** As a by-product of the capital allocation calculation over N user defined periods, KRM can also produce the probability that the institution will default in each period. The institution's default probability can be defined in various ways. A common choice is to measure the percentage of scenarios in period J in which the institution has mark to market capital that is negative. An alternative definition is the percentage of scenarios in period J in which the firm has both exhausted its marginal borrowing capabilities and its cash reserves.

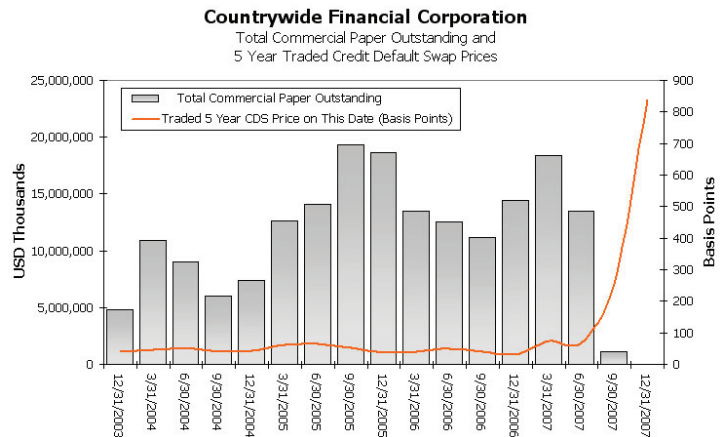
Kamakura calls this “inside out” default probability analysis because the institution is using its “inside” knowledge of the full balance sheet to estimate the default probability, which it can then compare to the “outside” world’s estimate of the default probability using only publicly available information.

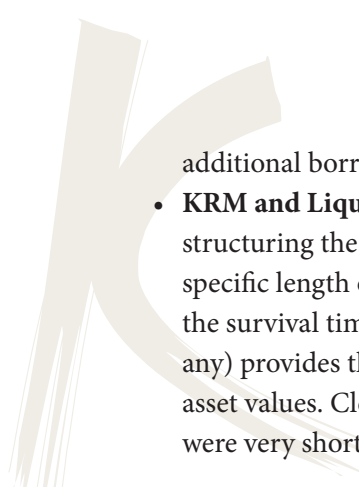
IX. KOPS for Liquidity Risk Management

In January 2008 it was announced that Bank of America would buy mortgage lender Countrywide Financial Corporation. Like the case of Northern Rock, home price declines were devastating for Countrywide’s mortgage business. As investors perceived higher default risk for Countrywide, 5

year credit default swaps on Countrywide broke out of a narrow range between 50 and 100 basis points and climbed to almost 300 basis points by September 30, 2007. The result was a 94% decline in Countrywide’s ability to issue commercial paper. By December 31, 2007, credit default swap quotes exceeded 800 basis points and Countrywide was completely shut out of the commercial paper market. KOPS using Kamakura Risk Manager allows clients to carefully measure how movements in macro-economic factors like home prices and interest rates can affect liquidity risk and the institution’s ability to fund itself with both retail and wholesale deposits.

- **KRM for Liquidity Risk Analysis:** By modeling the transmission of risk from the asset side of an institution (like the mortgages at Countrywide which dropped in value when home prices fell) to the liability side, KRM can very accurately measure an institution’s own risk of failure. “Liquidity risk” is like the high body temperature of a patient with an illness. The high body temperature in and of itself, just as “liquidity risk” is not an independent risk. Liquidity risk is the process by which some other type of risk (credit risk, interest rate risk, operational risk, foreign exchange risk) that devastates the value of assets leads to the failure of the institution.
- **KRM and the Timing of Default:** As mentioned in the non-maturity deposit section, even retail depositors fled Northern Rock as falling home prices devastated the value of the mortgages held by the bank. Within KRM, users have a rich array of modeling techniques by which to simulate the supply of liabilities and the pricing of liabilities to the institution as its risk changes. In addition, users can look at the timing of failure in multiple ways. Two of the most common ways are to define the timing of failure as the time when (a) the mark to market value of capital becomes negative or (b) the available sources of





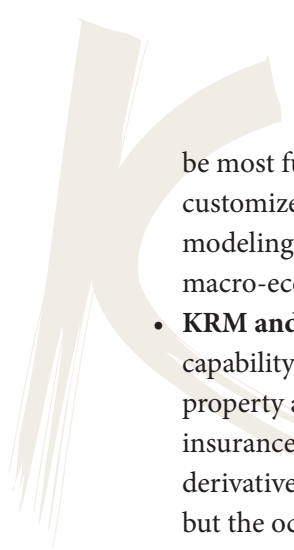
additional borrowings and cash reserves are exhausted.

- **KRM and Liquidity Risk Management:** Liquidity risk management is the process of structuring the liability side's maturity profile in such a way as to insure survival for a specific length of time using the second definition of failure in the prior paragraph. Given the survival time policies set by management, KRM can show what liability strategy (if any) provides the ability to survive for the desired length of time in the face of deteriorated asset values. Clearly in the case of Countrywide and Northern Rock, the survival times were very short for the sharp drop in home prices that occurred.

X. KOPS for the Insurance Industry

KOPS using Kamakura Risk Manager allows clients to simulate a rich array of insurance events. Using modern probability techniques, clients can simulate the probability of occurrence of events like default/no default, prepay/don't prepay, pay on a life insurance policy or don't pay, and so on. KOPS using Kamakura Risk Manager allows leading edge actuaries to explicitly incorporate the impact of the economy on mortality rates, as recent economic developments in Russia and Japan make so clear. Similarly, the advance of medical technology and the impact on mortality of new diseases can be simulated in a rich and realistic way, consistent with the most recent developments in medical statistics. KOPS for the insurance industry has the following features:

- **KRM and the Mathematics of Mortality Rate Modeling:** In 1971, D.R. Cox published a famous paper on the use of continuous time mortality rates for the pricing of life insurance policies. These probabilities, known as "Cox processes," are the basis for modern credit risk modeling known as the reduced form approach. Robert Jarrow, Stuart Turnbull, David Lando, and many others have employed this approach in credit risk research. Because of their common basis on the same mathematics, the links between insurance and credit risk modeling are very strong. KRM fully exploits these links.
- **KRM and Mortality Tables:** Traditional mortality tables show the mortality rate for a relatively small number of attributes of the underlying insured, such as age, male/female, smoker/non-smoker, and so on. Mortality tables have the identical structure to the user-defined prepayment tables discussed in the asset and liability management section of this report. Kamakura would be very pleased to work with KOPS and KRM clients to incorporate mortality tables in KRM.
- **KRM and the Use of Logistic Mortality Rates:** Logistic regression has long been used in medical science to predict mortality as a function of the current health condition of the underlying subject, the exposure to various diseases, and the exposure to various treatment regimes. KRM has the ability to model mortality both as a function of medical and health inputs and economic conditions (as Japan and Russia have proven is relevant) in a realistic way.
- **KRM and Internal Mortality Models:** KRM can load internal mortality models directly for modeling forward, in a manner exactly parallel to the default modeling capabilities outlined in the credit risk section of this overview.
- **KRM and Customizing Mortality Models:** KRM's capabilities for modeling mortality can



be most fully exploited when Kamakura experts work on a consulting basis with clients to customize mortality rate models based on the user's mortality rate data base. Best practice modeling normally uses a monthly mortality data base so that the impact of medical and macro-economic factors can be captured most clearly.

- **KRM and Property and Casualty Insurance Models:** KRM's logistic regression capability can also be used to model accident/no accident, fire/no fire, and so on for property and insurance casualty liability valuation. Depending on the nature of the insurance contract, macro-economic variables may or may not be relevant. In weather derivatives, for example, the probability of a hurricane is independent of macro factors, but the occurrence of a hurricane can have a powerful effect on the credit risk of many counterparties (as in the New Orleans case). KRM can model this linkage.

XI. KOPS for FAS 157 "Level 3" Valuations

Financial Accounting Standard 157 requires institutions to accurately model thinly traded "hard to value" assets. KOPS using Kamakura Risk Manager provides a state of the art framework that generates completely transparent valuations and an understanding of how bid-offered spreads in thinly traded markets reflect sampling error and other uncertainties in the valuation process. Kamakura consultants are actively engaged in KOPS valuation services using KRM for sophisticated financial institutions around the world. KOPS for FAS 157 has the following features:

- **KRM and FAS 157 Accuracy:** The recent credit crisis has made it clear that aggregated data and unrealistic modeling assumptions were at the heart of inaccurate valuations both at the point of origination and after origination. KRM directly addresses these problems in a concrete way, outlined in the points below.
- **KRM and Transaction Level Data:** KRM can model at the most granular level of collateral, such as the individual mortgage loans underlying a mortgage backed security that in turn is one of the instruments in a collateralized debt obligation.
- **KRM and Macro-Factor Drivers of Default:** KRM, because it can handle transaction level granularity, can show directly what impact is unleashed from the change in a macro factor like home prices. A fall in home prices first increases the probability of the default on the mortgage. The volatility and rise in the mortgage default probability results in a fall in value of each individual mortgage and the mortgage-backed security. The fall in the value of the mortgage backed security and the subsequent defaults impact the value of a CDO tranche. Without this "see through" valuation capability, one would make the mistakes in valuation that Merrill Lynch and UBS noted in the introduction to this document.
- **KRM and Full Disclosure:** All Kamakura calculations are open and transparent to users and key advisors to the user, such as consultants and auditors. For this reason, KRM calculations are fully reconcilable, as required by best practice under FAS 157.

See the case study below for actual financial disclosure by a KOPS client in the United States.

XII. KOPS for FAS 133/IAS 39 Hedge Accounting Calculations

Both U.S. and international accounting standards require that institutions seeking hedge accounting treatment justify a hedge by showing that market values of the assets being hedged are appropriately correlated with the hedging instrument. KOPS using Kamakura Risk Manager automates the process of showing both prospective and historical hedge-related correlations.

- **KRM and Hedge Ratios:** As discussed extensively above, KRM links macro factors and the values of all instruments. Because this link applies both to the asset being hedged and the hedging instrument, KRM will accurately simulate forward the true economics that makes the hedge work.
- **KRM and Hedge Effectiveness Tests:** Looking backward, KRM incorporates the hedge effectiveness tests required by FAS 133/IAS 39 to show that there has been a historical (negative) correlation between the value of the asset being hedged and the value of the hedging position. KRM Version 7.1 generates results for three types of hedge effectiveness tests: value offset, regression, and correlation.

XIII. Web-based Reporting, Processing Volumes and Securities Coverage

KRM-rp for Web-based Reporting of KOPS Results

KOPS results can be made available to clients via the KRM Risk Portal KRM-rp. KRM-rp is a rich array of standard web-based risk reports that links directly to client-specific output generated using the Kamakura Risk Manager system.

KOPS Processing Volumes

Because of the flexibility of the Kamakura Risk Manager architecture, KRM is used by clients to process portfolios that range in size from a few hundred transactions to more than 92 million, a volume record currently held by one of the largest banks in China. It is common for KRM to be used on portfolios with millions of transactions because of the high speed processing that KRM can achieve. For this reason, the KOPS service has included a wide range of transaction volumes, from 10 transactions to many millions of transactions.

KOPS Securities Coverage

KOPS using Kamakura Risk Manager gives clients an extraordinarily comprehensive ability to value and produce cash flows and financial accruals for a very wide range of transaction types. KRM has steadily grown in its ability to handle complex securities as the market place has evolved. KRM can process equities, all standard fixed income instruments, insurance liabilities, odd-amortization “one of a kind” securities, collateralized debt obligations, foreign currency derivatives, interest rate derivatives, mortgage-backed securities and much more.

XIV. KOPS Modeling Choices

Kamakura is firmly committed to a multiple models approach to risk analysis. The KOPS client's ability to change modeling assumptions with a mouse click is essential for understanding potential model risk. It is also critical in allowing the client both to replicate existing "common practice" risk calculations while the client evolves from "best practice" or "common practice" to "emerging best practice." KRM includes a full range of alternative techniques for interest rate simulation, options valuation, yield curve smoothing, default modeling, prepayment modeling, insurance event modeling, foreign exchange rate simulation, and so on. The following analytical choices are available to those KOPS clients who wish to be "hands on" in model selection:

- **Default modeling:** Merton default models, reduced form default models, ratings based default models and transition matrices
- **Simulation of random default probabilities:** Historical sampling, correlated default probability simulation, macro-factor and other factor driven default probability simulation, time-based drifts in default probabilities
- **Simulation of credit spreads:** linear credit spread functions, logistic credit spread functions (see RISK Magazine, Jarrow, Li, Mesler and Van Deventer, September 2007), and random simulation of credit spreads on a correlated basis.
- **Fixed income options valuation:** closed form solutions, lattice solutions, and monte carlo solutions. Options can be exercised rationally or irrationally. Options can also be modeled as if the client is subject to transactions costs rather than assuming fully rational zero-transactions cost options exercise. Models employed include both term structure model-based options formulas and Black options formulas. All standard options types are included, such as European, American and Bermudan options.
- **Equity and foreign exchange options valuation:** The full range of Black-Scholes variations are included in KRM.
- **Futures contract valuation:** Futures valuations are fully consistent with the term structure of interest rates and modern no arbitrage financial theory
- **Prepayment modeling:** prepayment functions, prepayment tables, logistic probabilistic prepayment (KRM 7.2), and third party models like Andrew Davidson & Co.
- **Yield curve smoothing:** linear smoothing, four variations of cubic spline smoothing, and the Adams and van Deventer (1994) maximum smoothness forward rate smoothing. Data inputs for yield curve smoothing may be observable yields or raw bond prices, for both callable and non-callable bonds.
- **Credit spread smoothing:** the same six choices listed above for yield curve smoothing also apply to credit spread smoothing, where yields are calculated by smoothing relative to a user-specified risk free curve.

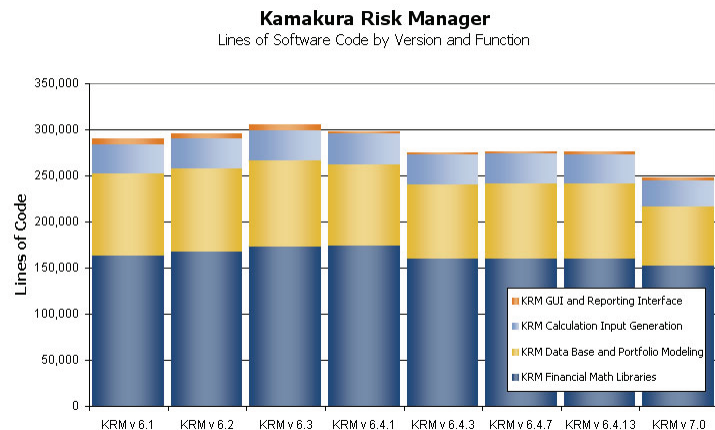
XV. KOPS Links to Kamakura Risk Information Services Default Probabilities

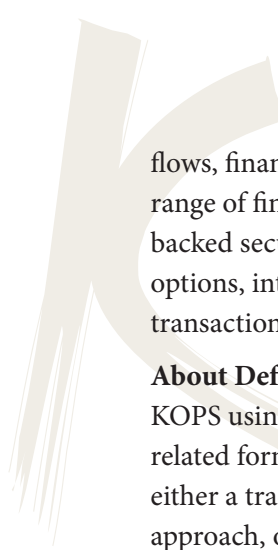
KOPS using Kamakura Risk Manager links seamlessly to the Kamakura Risk Information Services default models. This link allows clients with KRM and KRIS licenses to load KRIS default probabilities, default formulas, and default correlations into KRM for analysis with the click of a mouse. No other enterprise wide risk systems vendor offers these capabilities. Kamakura Risk Information Services was launched in 2002. KRIS now includes default probabilities on more than 20,000 public firms in 30 countries. KRIS also includes default probabilities for 180 sovereign nations. In addition to the default probabilities themselves, KRIS includes the pair wise correlation in the default probabilities for any pair of companies for accurate modeling of correlation in the events of default. See Jarrow and van Deventer (RISK Magazine, 2005) for use of this correlation in simulating random defaults.

About Kamakura Risk Manager, Version 7.1

Kamakura Risk Manager, first offered commercially in 1993, has been under continuous expansion and improvement since the first lines of code were written in 1990. The KRM system is written in modern C++ class libraries that are constantly being improved from a speed and accuracy point of view. KRM version

7.1, for example, contains much more functionality but 19% fewer lines of code than KRM version 6.3 as shown in the graph below. KRM comes with a rich data base architecture that is Open Data Base Connectivity compliant with proper security. KRM runs on both Windows and Unix, and relational data bases like MS SQL Server, Oracle, and Sybase can all be used with KRM. KRM currently supports the following data bases for use on 64-bit servers: MS SQL 2000 and 2005 and Oracle 10G R2. Beginning with KRM Version 7.0, the KRM application server will run only on Windows, but the data base servers can be run on both Unix and Windows platforms. Kamakura Risk Manager is designed as a multiple-models risk management system, featuring a rich array of interest rate simulation techniques, default modeling approaches, prepayment simulation alternatives, and embedded options valuation methodologies. Kamakura Risk Manager is delivered with an optional set of Java-based web tools including the KRM-Risk Portal (rp) for wide dissemination of risk reports around the organization, KRM-Data Manager (dm) for easy data loading to KRM tables, KRM-Limits Manager (lm) for state of the art risk limits monitoring, and KRM-Loan Pricing (lp) for modern risk-adjusted return on capital loan pricing. KRM produces cash





flows, financial accruals, and valuations at all user-defined forward time periods for the full range of financial instruments, from collateralized debt obligation tranches to mortgage backed securities to simpler instruments like bonds, deposits, loans, credit default swaps, options, interest rate swaps, life insurance policies, non-maturity deposits, foreign exchange transactions, and so on.

About Default Probabilities in KOPS

KOPS using Kamakura Risk Manager allows clients to specify default probabilities and related formulas for retail, small business, corporate and sovereign counterparties using either a traditional ratings-based transition matrix approach, the legacy Merton-style approach, or the state of the art reduced form modeling approach.

Making the Transition from KOPS Client to KRM User

The credit crisis has convinced many institutions that their legacy risk systems are inadequate for a realistic assessment of risk. This is particularly true for clients who analyzed interest rate risk in a silo fashion, ignoring home prices as a risk factor. It is also a very common conclusion for institutions that relied on 35 year old Merton default probabilities and historical value at risk. With the KOPS service, institutions who need an immediate upgrade in their risk systems can subscribe to the KOPS service for a pre-specified amount of time, allowing the client the time to install Kamakura Risk Manager on its own site, transitioning to “KRM user” from “KOPS client” in a very smooth and reasonable fashion. Many see this model as the best practice method for major risk systems upgrades.

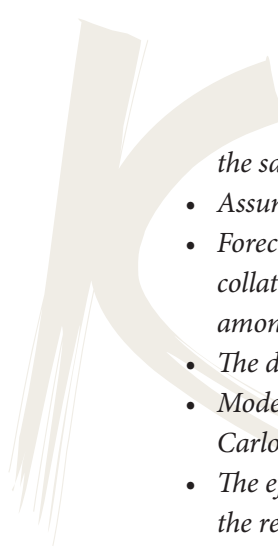
XVI. KOPS: A Case Study from a Client’s 10-k Report to the Securities and Exchange Commission December 31, 2008

The following description is taken directly from the December 31, 2008 filing of a KOPS client to the U.S. Securities and Exchange Commission. It provides a realistic description of how the KOPS service allowed the client to meet “best practice” financial reporting requirements:

Securities:

For those securities that cannot be priced using quoted market prices or observable inputs a Level 3 valuation is determined. Given the conditions in the debt markets, the absence of observable transactions in the secondary and new issue markets, and the overall inactivity of the market we determined that some of our trust preferred securities should be classified within Level 3 of the fair value hierarchy. In certain situations we use independent third parties to help prepare the valuations for some of our trust preferred securities. The approach used to determine the fair value of some of our trust preferred securities involved the following steps:

- *Estimation of the credit quality of the collateral using average probability of default values for each issuer (adjusted for rating levels);*
- *Consideration of the potential for correlation of default probabilities among issuers within*



the same industry (e.g. banks with other banks);

- Assumption of loss given default was assumed of 95% (i.e. a 5% recovery);*
- Forecasting of cash flows for the underlying collateral and application to each collateralized debt obligation (CDO) tranche to determine the resulting distribution among securities;*
- The discounting of expected cash flows to calculate the present value of the security;*
- Modeling of the calculations were modeled in several thousand scenarios using a Monte Carlo engine with use of the average price for valuation purposes.*
- The effective discount rates are highly dependent upon the credit quality of the collateral, the relative position of the tranche in the capital structure of the CDO and the prepayment assumptions. The approach used to fair value our other multi-issuer CDOs involved the use of a model that was developed by a leading risk management solution providers. The approach used to determine the fair value of these CDOs involved the following steps:*
- The one and five year default probability was determined for each issuer in the pool based on the Kamakura Risk Information Services model;*
- The default probability for insurance issuers was developed using 22 macro factors which drive the default for mid-size insurance companies through the use of a logistic regression model;*
- Twenty-seven macro factors were candidate variable for macro driven default rates; and*
- 100,000 Monte-Carlo simulations were run in annual time stops until maturity to derive a fair market value.*

The approach utilized by our consultant uses a multifactor default model incorporating market/macro economic factors as well as unsystematic factors. This approach establishes the line between market and credit risk and provides a framework for dynamic instead of static market and credit risk modeling. Reduced form default probabilities by our consultants are seen as the most modern and most accurate approach to default probability assessment. The use of 100,000 scenarios was done to minimize statistical error.

We evaluated current defaults and deferrals from trustee reports, structural support within the CDO, and the coupon rate at the Cusip level compared to the coupon on the tranche. In evaluating these factors we examined the trustee reports to determine current payment history and the structural support that existed within the CDO at year-end. We incorporate the modeling for evaluating future deferrals and defaults and coupon rates based on the current swap curve to project future cash flows. Several scenarios were done involving different levels of liquidity risk.

Because of the lack of an active market, the determinations of fair value assume that market participants would utilize the same assumptions in determining a price.

XVII. About Kamakura Corporation

Founded in 1990, Kamakura Corporation is a leading provider of risk management information, processing and software. Kamakura has been a provider of daily default probabilities and default correlations for listed companies since November, 2002. Kamakura launched its collateralized debt obligation (CDO) pricing service KRIS-CDO in April 2007. Kamakura is also the first company in the world to develop and install a fully integrated enterprise risk management system that analyzes credit risk, market risk, asset and liability management, transfer pricing, and capital allocation. Kamakura has served more than 185 clients ranging in size from \$3 billion in assets to \$1.6 trillion in assets. Kamakura's risk management products are currently used in 27 countries, including the United States, Canada, Germany, Russia, the Netherlands, France, Switzerland, the United Kingdom, Eastern Europe, the Middle East, Africa, Australia, Japan, China, Korea and many other countries in Asia.

Kamakura's research effort is led by Professor Robert Jarrow, who was named Financial Engineer of the Year in 1997 by the International Association of Financial Engineers. Professor Jarrow and Kamakura founder Dr. Donald R. van Deventer were both named to the 50 member RISK Hall of Fame in December 2002. Kamakura management has published more than 100 publications on credit risk, market risk, and asset and liability management. Kamakura has world-wide distribution alliances with Fiserv (www.fiserv.com), Unisys (www.unisys.com), and Zylog Systems (www.zylog.co.in) making Kamakura products available in almost every major city around the globe.



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