

P.R.I.M.E. Finance

Panel of **R**ecognized **I**nternational **M**arket **E**xperts in **F**inance

Derivatives Valuation



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Mid-market versus Fair/Replacement Value

- **Fair/Replacement Value:** the price at which a counterparty could execute a new trade or replace an existing trade by **hitting a dealer bid or lifting a dealer offer** (Note: IFRS 13 defines fair value as “the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date”.)
- **Mid-Market:** the midway point between the bid price and offer price at which a new trade could be executed
- **Example (10 year USD Fixed for Floating Interest Rate Swap)**
 - Bid: 2.39%
 - Offer: 2.41%
 - Mid-market: 2.40%



Contexts in Which Valuation Matters (and Whether Mid-Market Value or Fair/Replacement Value is Appropriate)

- Trade Pricing/Execution
- Post-Trade Risk Management and Economic Capital Allocation
 - Sensitivity Calculations (e.g., DV01, CS01), VaR and Stress Testing
 - Counterparty Credit Risk Assessment
- Periodic Marking to Market
 - For P&L/Accounting
 - For Clients
- Collateral Calls/Returns
- Termination Events
 - “No Fault” Termination Events (Illegality/Force Majeure)
 - Single Affected Party Termination Events
 - Optional Terminations (“Break Clauses”)
- Events of Default



Challenges in Derivative Valuation

- Level 1 Derivatives:
 - A “Level 1” derivative instrument is one that is traded in an active and liquid market and for which price quotations are available on a continuous basis. The quoted market bid or offer price provides the most reliable gauge of value and is used without adjustment.
 - There is no challenge in valuing Level 1 derivatives once the Bloomberg terminal is switched on.
- Level 2 Derivatives:
 - A “Level 2” derivative is one for which market price quotes are not available and which, therefore, requires a model-based valuation and therefore, entails approximation¹.
 - All pricing inputs are based on observable market data.
 - The challenge in valuing Level 2 derivatives lies in implementing the appropriate derivative valuation models.
- Level 3 Derivatives:
 - A “Level 3” derivative is one for which market price quotes are not available and which, therefore, requires a model-based valuation.
 - Critical pricing inputs are not based on observable market data, but must themselves be modeled.
 - The challenges in valuing Level 3 derivatives lie in implementing the appropriate derivative valuation models and in implementing the appropriate models for estimates of pricing inputs.

¹Statistician George Box wrote most famously “All models are wrong but some are useful”.



Hedge Cost Adjustments

Dealers pass along the costs of hedging their derivative exposures. Rutter Associates has observed the charges applied by a number of dealers to:

- Estimates of the sensitivity of Derivative value to changes in the “underlying”, e.g.,
 - Rates
 - Spreads
 - Equity and Commodity Prices
- Estimates of the sensitivity of Derivative value to changes in volatility
- Estimates of other key risk sensitivities such as to correlation.

Rutter Associates calculates these sensitivities from our derivatives valuation models and applies the appropriate dealer charges in calculating Hedge Cost Adjustments from mid-market to replacement values.



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CVA and DVA

CVA is the (risk neutral) present value of expected losses in a derivative position due to your counterparty's default.

DVA is (risk neutral) present value of expected losses to your counterparty in a derivative position due to your default.

- The financial crisis drove home the importance of pricing both (although DVA recognition for existing exposures led to some ironic results).
- The financial crisis further drove home the importance of understanding *wrong-way* counterparty default risk (the increased tendency of your counterparty to default when you are in the money – e.g., AIG and the Monolines).

Rutter Associates calculates these by simulating Market-to-Market exposures over the lifetime of a derivative using market-implied inputs for trends and volatilities and simultaneously simulating correlated default events also using market-implied incremental default probabilities. Problem is much simpler when correlation = 0.



FVA

FVA is the (risk neutral) present value of net funding costs a dealer bears in providing an OTC derivative contract to an end-user. The theory of FVA has not been fully worked out – however it is a market reality.

- Derivative desks charge their funding costs from the dealer's Treasury unit (as opposed to an implied "risk-free" rate) when entering into positive NPV off-market derivatives.
- MVA: Derivative desks charge the difference between their funding costs from the dealer's Treasury unit and the yield they receive (e.g. OIS) when posting initial margin.
- CollVA: Derivative desks charge the difference between their funding costs from the dealer's Treasury unit and the yield they receive (e.g. OIS) when posting collateral to hedge counterparties when collateral agreements are asymmetric.



KVA

- **Capital Valuation Adjustments** are explicit charges that some desks may levy to assure that their profit in a derivative transaction is sufficient to clear return hurdle against an allocation of regulatory capital or an attribution of economic capital. These capital allocation/attribution captures the derivative's contribution to the dealer's tail risk that is not otherwise accounted for in other adjustments.
- Rutter Associates has generally found that KVA is very sensitive to how fully trades are collateralized, and largely captures the risks of adverse CVA evolution to the extent CVA is not fully hedged.
- KVA is a cost add-on that is *very much specific to each dealer*.



Model Risk Valuation Adjustments

Model Valuation Adjustments are charges that account for potential suboptimal model choice, calibration or implementation and other model imperfections that invariably plague the analysis of complex derivatives.

There is no uniform or standard practical or theoretical approach to charging for “model risk”, but dealers generally increase their charges with increasing risk of:

- Inappropriate simplifying assumptions
- Poor fit to realized prices
- Standard errors in numerical approximation (e.g. Monte Carlo estimates)
- Faulty calibration of model parameters

Rutter Associates applies Model Valuation Adjustments as directed by a specific dealer when appropriate and judgmentally otherwise.

One approach involves us using alternative models and applying an adjustment determined by the dispersion of those model results.



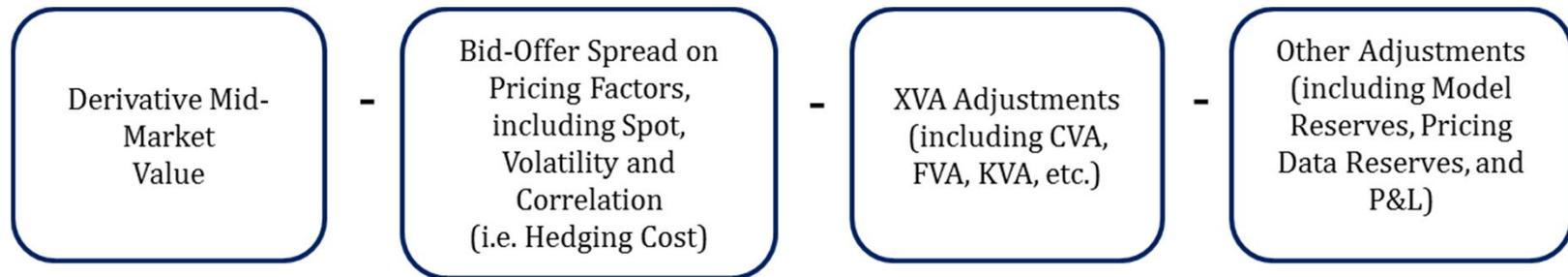
Pricing Input Uncertainty Adjustments

Pricing Input Uncertainty Adjustments are usually statistical add-ons made to estimates of OTC derivative pricing factors that cannot be directly observed or implied from the prices of traded instruments.

- Key Data Inputs
 - Spot price (for the underlying, e.g., rates, equities, FX, commodities or credit)
 - Volatility (if any option embedded in the trade) – preferably market implied
 - Correlation (if more than one underlying in the trade) – preferably market implied
 - Bid-offer spreads on the above factors
 - Term structure of interest rates
- Wherever possible, market data that are observable or implied from market prices should be used
 - The key challenge is sourcing these data, but there is an abundance of data vendors from which they can be obtained (e.g., Bloomberg, Thomson Reuters, Totem)
 - Oftentimes midday data are required (as opposed to market open or market close) and these can be challenging to locate
- The prices of Level 3 derivatives are based on valuation techniques that require inputs that are both unobservable (especially after the fact) and significant to overall fair value measurement
 - These inputs (particularly correlations and occasionally volatilities) are often estimated from historical data as opposed to market-implied data
 - Notable examples of these derivatives include those based on spreads among asset prices for which implied correlations are unavailable



Derivatives Valuation: Summary



Rick Grove

Rick Grove is a Partner and the Chief Executive Officer of Rutter Associates LLC, the New York based financial markets risk management consulting firm. Rutter Associates' consulting practice encompasses a wide range of financial markets risk management and valuation advisory work for financial institutions, corporations and regulators in the Americas, Europe, Asia and the Middle East. In addition to managing Rutter Associates, Rick's own practice focuses on derivatives and structured credit products. He has acted as a consultant and expert on a variety of disputes being mediated, arbitrated or litigated in New York, London, Hong Kong, Singapore and Taipei.

Rick has spent over 30 years working in the financial markets, as both an investment banker and a lawyer. From 1997 to 2001, he was the CEO of the International Swaps and Derivatives Association (ISDA). Following ISDA and before joining Rutter Associates, Rick was a Managing Director at Bank of America, co-managing the Global Commodity Derivatives Group. Prior to joining ISDA, he worked as a marketer in the fixed income and derivatives businesses at Paribas Capital Markets and headed the Financing Desk and the Fixed Income Syndicate Desk in New York. Rick originally joined Banque Paribas as General Counsel of Paribas Corporation after practicing capital markets, mergers & acquisitions and general corporate law with Cravath, Swaine & Moore in New York and London.

Rick is a member of the panel of experts of P.R.I.M.E. Finance, the financial markets dispute resolution service based in The Hague. He currently serves as Senior Advisor to the American Bar Association's Task Force on Financial Engineering for Economic Development. He has served on the CFTC's Global Markets Advisory Council and the World Bank's Financial Markets and Development Conference Advisory Board. Rick has chaired ISDA's U.S. Regulatory Committee and has testified about the derivatives markets before the U.S. Senate and U.S. House of Representatives. He has served on ISDA's panel of experts for credit event determinations.

Rick authored "*Valuation in the context of derivatives litigation*" in the April 2011 issue of the *Oxford University Capital Markets Law Journal* and a chapter entitled "*Overview of Derivative Products*" in *International Financial Disputes: Arbitration and Mediation* (published March 2015 by Oxford University Press). He has taught classes on derivatives, structured credit products and risk management at Columbia University, Fordham Law School, New York University, Princeton University, the University of St Andrews, National Taiwan University College of Law, the U.S. Commodity Futures Trading Commission in Washington, the Practising Law Institute in New York, the Bank of China Institute for International Finance in Beijing, China International Economic and Trade Arbitration Commission (CIETAC) in Beijing, and for banks and law firms in New York, London, Amsterdam, Brussels, Hong Kong, Singapore, Stockholm, Taipei, Tokyo and Washington. Rick has conducted training sessions on the economics of financial markets transactions for the judges of the Australian Federal Courts in Sydney and Melbourne, the judges of the Supreme Courts of the states of New South Wales and Victoria in Australia, the justices of the Delaware Supreme Court and Delaware Chancery Court (USA), Chilean judges at the Instituto de Estudios Judiciales in Santiago (Chile), Romanian judges at the Institutul National al Magistraturii in Bucharest (Romania), the justices of the Singapore Supreme Court and judges in Taiwan at the Judges Academy.

Rick is a member of the International Institute for Strategic Studies (IISS) in London, the Atlantic Council in Washington, the bar of the State of New York, the American Bar Association's International Section, the International Advisory Committee of EcoPeace Middle East and the Board of the University of St Andrews American Foundation. He is President of the Board of Directors of the U.S. Friends of the IISS.

Rick received his J.D. *magna cum laude* from Harvard University, where he was an editor of the *Harvard International Law Journal*, and his A.B. *summa cum laude* from Princeton University where he was enrolled in the Woodrow Wilson School of Public and International Affairs.



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Rutter Associates

Rutter Associates is a leading financial risk management consulting firm. The firm's areas of expertise include:

- assessment and management of market risk, credit risk and liquidity risk associated with financial market positions and transactions;
- valuation of financial assets and liabilities, including derivatives and complex structured credit products;
- investment portfolio risk/return analytics and processes;
- model development, review and validation;
- analysis of derivative hedge effectiveness, asset replication and income generation;
- regulatory examinations;
- financial market forensics, investigations and dispute resolution support; and
- training and education.

Since its founding in 1999, Rutter Associates' clients have included global and regional banks, asset managers, insurance companies, industrial companies, government agencies and regulators and financial market industry associations and utilities. The firm's clients include leading financial institutions and others in Australia, Canada, China, France, Germany, Israel, Japan, Korea, Mexico, the Philippines, Singapore, Sweden, Switzerland, Taiwan, the United Kingdom and the United States.

Rutter Associates is led by Rick Grove (CEO), Bob Selvaggio (Head of Analytics) and Charles Smithson (Founding Partner), each of whom has more than 30 years of experience in the financial markets. A team of highly talented mathematicians and engineers rounds out the firm's full-time professional staff. The team is complemented by a diverse group of leading academics and retired financial markets executives who devote part of their time to working with the firm's clients.

Rutter Associates maintains close ties to the financial industry and has been active in various industry associations, including several benchmarking and sound practice development exercises. The firm also maintains close working relations with regulators and academics. Members of the Rutter Associates team are frequent lecturers at educational conferences and have published numerous books and articles on issues relating to risk management, valuation and financial market industry practice.



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