P.R.I.M.E. Finance

Panel of Recognized International Market Experts in Finance

Derivatives Valuation

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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 *approximation*[1].
  - 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.

[1]Statistician George Box wrote most famously ""All models are wrong but some are useful".

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: 1.64%
  - Offer: 1.66%
  - Mid-market: 1.65%

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.

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/attributions capture 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

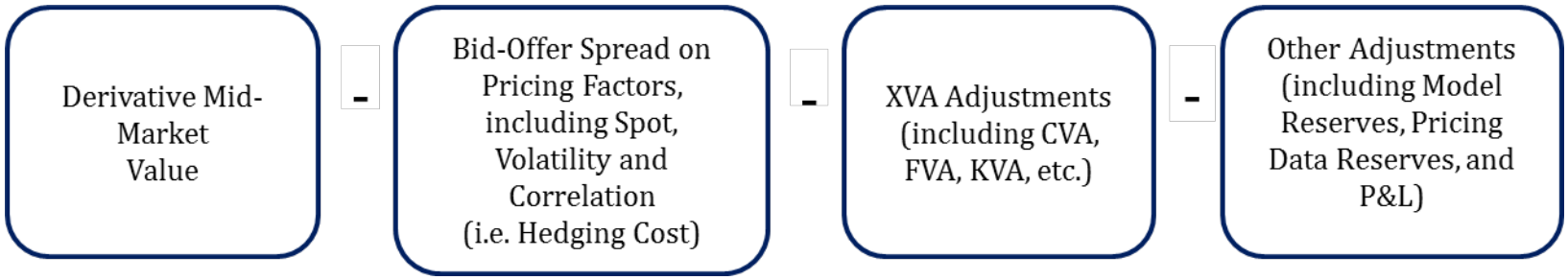
Pricing Input Uncertainty Adjustments are usually statistical add-ons made to estimates of OTC derivative pricing factors that cannot be directly observed or implied from the prices of traded instruments.

- 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



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