An OTC Valuations White Paper

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FAS 157 – *Derivative Valuation Insights™*

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Contents

FAS 157 presents numerous valuation challenges to users of financial derivatives.

Introduction

This article will be of interest to those facing challenges valuing derivatives or verifying the value of their derivatives, and those that are thinking of starting to use derivatives or expanding their use into more exotic structures. Whether motivated by investors, internal risk controls, or regulations, increased valuation transparency will benefit users of financial derivatives.

We briefly look at FAS 159, FAS 133 / IAS 39, and pay particular attention to FAS 157, focusing on the requirements for derivative valuation and how best to approach these regulations. This article outlines:

- Definitions of commonly used terms related to derivative valuations
- Historical drivers of independent derivative and financial security valuations
- Industry responses and the continued trend towards fair value accounting
- How regulations have adapted, the latest addition being Statement 157
- Current and future requirements of financial instrument valuation and reporting
- Derivative valuation insights, including challenges and solutions to consider
- Concluding thoughts surrounding Statement 157 and derivative valuations

Definition of Related Terms

There exists a fair amount of terminology surrounding derivatives, much of which is used interchangeably. For the purposes of this white-paper, we define the following groups of terms:

Security, Instrument, Trade, Deal, Transaction, Position
All of the words above refer to a financial contract, such as a bond or stock. Prefixing with *derivative* will refer to options, swaps, foreign exchange forwards, and other financial derivatives.

Deal Sheet, Term Sheet, Deal Confirm, Trade Confirmation, ISDA Agreement
Such words refer to the document that describes the terms of the derivative contract, such as expiry date, notional amount, and other variables.

Complex, Illiquid, Hard-to-Value, Exotic, Structured Product
The above words describe any derivative that does not have a readily quoted or accessible price; these are normally custom structured derivatives that are thinly traded and difficult to model.

Vanilla, Liquid
Liquid or vanilla refers to actively traded derivative securities, which have readily-quoted prices and are easy to understand and value, such as interest rate swaps or European swaptions.

Mark-to-model involves calibration of models to market-quoted prices.

Pricing, Fair Value, Evaluation, Evaluated Pricing, Valuation
These terms all refer to the dollar amount that a security is worth at some point in time. However valuation often refers to a mark-to-model **calculated** price rather than a mark-to-market **quoted** price. All measures of fair value, as defined by FAS 157, refer to "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."

Dealer Mark, Indicative Price
Dealer marks are usually mid-market indicative prices that represent some average price level of the transaction for a given date; these marks do not represent prices at which a deal would be conducted.

Mark-to-Market versus **Matrix Pricing** versus **Consensus Pricing** versus **Mark-to-Model**
Fair value using a mark-to-market approach means utilizing a market quoted price for the security, usually available from the financial press. When a security has no readily available direct market quote but quotes are available for very similar securities, one can discern the fair value through relative value analysis or a matrix pricing approach, which may be simple price interpolation or involve more complex analysis or algorithms. A consensus price is a derived single price based on several quoted prices. The most accurate pricing method for securities that are not readily quoted in the market is the mark-to-model approach, which involves the application of mathematical models that are calibrated to mark quoted prices.

OTC versus **Exchange-traded**
Over-The-Counter derivatives are privately negotiated financial contracts between two parties. Exchange-traded derivatives are standardized financial contracts that trade on an exchange.

Analytics, Models, and Methods
These terms are used interchangeably to describe the mathematics, equations, algorithms, and techniques used to calculate an instrument's fair value.

A goal of fair value accounting has been to provide ever-more transparent financial statements.

Brief History of Derivative Regulations

In the early part of the decade, the Financial Accounting Standards Board (FASB) and the International Accounting Standards Board (IASB) released their respective Statements, FAS 133 and IAS 39, forcing a dramatic change in the accounting treatment for financial instruments and related derivatives. This change largely involved the disclosure of derivative positions on public financial statements: moving from the footnotes into the income statement and balance sheet. Step one of many on the road to fair value accounting had been taken.

As much of the industry relied on dealer marks, valuation was not immediately seen as a material concern or challenge, with the focus and disgruntlement aimed at the requirements of hedge effectiveness and its related testing.

In the years that followed, there grew a greater awareness of market risk management and the benefits of gaining a deeper understanding of financial instruments, derivatives, and their associated risks and rewards. Many treasuries and other buy-side participants started to evaluate the merits of bringing the valuation function in-house, with a good degree of implementation success via software and systems for vanilla derivatives. As the complexity of derivatives increased and regulation called for greater transparency of risk, some firms discovered that it was not economical to have an in-house solution for these opaque structures. This led to the fairly new market of outsourced OTC derivative valuations which served as a primary, secondary, or even tertiary source of opinions on a derivative's fair value.

During this time, given the imperfect solution that FAS 133 and IAS 39 (and subsequent updates) provided in terms of special treatment of hedged positions, both accounting bodies introduced a new or appended Statement where fair-value hedges would see both the derivative and hedged item measured at fair value, with changes in fair value reported in earnings. Cash flow hedge treatment remains the same. For details, see FAS 159 (an extension to FAS 157) and IAS 39 (as amended).

FAS 157 defines fair value as an "exit price" for the sale of an asset in normal market conditions.

Today's Environment: FAS 157 – Derivative Valuation Options

Given the recent regulatory and financial accounting requirements, counterparty marks are no longer a good proxy as an independent source of fair value, and many derivatives users are searching for different primary pricing sources and additional avenues of price verification.

More specifically, financial accounting requirement changes introduced by the FASB with Statement 157 have provided clarification and direction on how companies should measure fair value of financial instruments such as derivatives. FASB endorses the use of market data to measure fair value, and attempts to clarify to the valuation process by providing guidance on using observable and unobservable inputs. These inputs have been segregated into a fair value hierarchy of inputs, where the highest priority is given to quoted prices in active markets for identical securities (Level 1) and lowest priority to unobservable inputs (Level 3). Regardless of which Level is used, fair value must represent "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants", according to paragraph 5 in Statement 157. Fair value is an exit price but not for a distressed sale or liquidation.

Briefly, Level 1 inputs refer to quoted prices (e.g. equity prices) available in active markets for liquid instruments. Level 2 inputs refer to using quoted prices as inputs to construct the price for a particular instrument that is unobservable or where it is "good enough" to use instruments with similar attributes to determine the fair value of an unobservable instrument. Level 3 inputs refer to unobservable quantities (e.g., calibrated model parameters) that are used to derive fair value.

Each level of inputs is used to assess the fair value of derivative products. For liquid derivative instruments, it is anticipated that market participants will make use of Level 1 inputs. For all non-liquid derivative products, Level 2 and 3 inputs should be used to determine fair market value. A summary table of Level 1, 2, and 3 inputs with respect to exchange-traded and over-the-counter derivative products is presented on the following page. For further details, please refer to paragraphs 24 through 30 in Statement 157.

For Level 2 observable inputs, mark-to-model is a more accurate valuation method than mark-to-matrix.

	Input Types	Input Example	Instrument Examples	Valuation Approach
LEVEL 1	**Unadjusted quoted market prices** in active markets for identical assets or liabilities.	Prices from exchange-traded markets (NYSE, NASDAQ) and dealer markets (over-the-counter markets).	Exchange-traded investments, futures, and actively traded debt.	*Market approach* using **Mark-to-market**
LEVEL 2	Quoted prices for similar instruments or inputs derived from **observable** market data.	Interest rates and yield curves at commonly quoted intervals, implied volatilities, and credit spreads.	Vanilla interest rate swaps and many credit default swaps.	*Market approach* using **Mark-to-matrix**
LEVEL 3	**Unobservable** inputs developed using the reporting entities' estimates and assumptions, which reflect those that market participants would use.	Expected cash flows, historical volatility, forward prices beyond the term for which observable quotes exist, or model parameters such as mean reversion.	Long-dated currency swaps and callable range accrual swaps.	*Income approach* using **Mark-to-model**

An organization can employ one of several valuation techniques to determine the fair value of a security that requires Level 2 or 3 inputs, as outlined in paragraph 18 of Statement 157. One such approach for Level 2 is to employ matrix pricing where similar securities are used to interpolate fair value. For example, one may value a vanilla interest rate swap by relying on its relationship to other benchmark quoted swaps.

Even though matrix pricing has its advantages of being quick and easy, the interpolated price is only as good as the data used in the matrix pricing algorithm. In using matrix pricing to generate an interpolated price that reflects market conditions, the attributes of the securities used in the algorithm must be closely aligned with the attributes of the security in question. A good rule of thumb is that the greater the similarities, the more accurate the price will be. However, a common problem with matrix pricing is finding enough similar traded securities to generate an accurate measure of fair value.

A more accurate approach [using Level 2 or 3 inputs] is to use a mark-to-model valuation methodology, where mathematical models allow for the precise consideration of factors specific to the security at hand. While we could rely on matrix pricing for a vanilla interest rate swap, a model that takes into account the specific day-count method (such as 30/360 versus act/360) would lead to much more accurate results.

The use of mid-market pricing isn't precluded by FAS 157.

The advantages to using the mark-to-model valuation technique are:

ACCURACY. The security's attributes, such as accrual method and business day convention, are directly used in the algorithm to determine fair value, thus generating a more accurate fair value measure. There are instances where differences in just the day count method (i.e. 30/360 versus act/360) will lead to a material valuation difference of the same instrument.

INDEPENDENCE. It is safe to assume that the counterparty employs sophisticated mark-to-model pricing; using a similar methodology provides independent price verification and a sanity check, thus reducing your dependency on counterparty marks without compromising accuracy.

TRANSPARENCY. Successfully employing mark-to-model valuations requires thorough analysis of the instrument, related risks, and modeling and market data requirements. This analysis directly translates into greater transparency and understanding of derivative valuations and any assumptions being made in the valuations. You are now better positioned to understand the process and drivers behind a valuation.

Bid and Ask Price Considerations

It is worth noting that even though paragraph 31 of FAS 157 does not preclude the use of mid-market prices to construct fair value measures, the FASB does recommend organizations use prices that reflect the assumptions market participants would use in pricing the derivative. For example, if you are long a bond and wish to sell the bond, you as the seller of the bond should use the price market participants are willing to pay (their bid price) to measure fair value. Conversely, if you are buying a bond you should use the price market participants are willing to sell it at (their ask price) to measure fair value. The price within the bid-ask spread that is most representative of fair value in the particular circumstance must be used. However, mid-market pricing may be practical and expedient for making measurements of fair value within a bid-ask spread.

Paragraphs 16 and 17 of Statement 157 discuss fair value at initial recognition, specifically cases in which the transaction price does not equal the exit price. Though the examples do not specifically state the difference between bid and ask prices, one can safely assume that the price paid for a security, such as an interest rate cap, will not be the same as the price the security would be sold for at exactly the same moment in time, the difference being accounted for due to bid and ask pricing. Therefore the mid price is likely not the best representation of the security's exit price. For a swap example, see Appendix A of FAS 157, section A27.

Apart from knowing the deal's structure and risk exposure, one must take great care in using the correct data when calculating fair value.

Derivative Valuation Insights

Because most over-the-counter (OTC) derivatives and structured products require Level 2 or 3 inputs and benefit from a mark-to-model approach to arrive at a true fair value under normal market conditions, it is instructional to review the valuation challenges and the considerations necessary to overcome them. Insights are provided surrounding the:

1. term sheet,
2. associated risks [of the instrument],
3. market data requirements,
4. analytics requirements,
5. necessary disclosures, and
6. automating the process.

*Challenge 1: Understanding the **term sheet** or deal confirm*

Vanilla deals are fairly standard and easy to interpret. They can, however, contain certain nuances, such as whether rates are set in advance or in arrears, which sometimes escape the untrained eye. Term sheets for more exotic structures require careful analysis as they are largely custom structures with little standardized terminology or parameters. It is important to have an internal or external expert review the term sheets to ensure all aspects of the trade are taken into account during valuation.

*Challenge 2: Understanding a derivative's behavior in various market conditions and **associated risks***

Such understanding is paramount when selecting a mathematical model for valuation that contains the appropriate risk factors. Stress testing and scenario analysis should be conducted by varying inputs to the model to ascertain how sensitive a security's fair value is to changes in specific market conditions. An experienced market practitioner can assist to ensure that the model used will take into account the appropriate data and risk factors.

*Challenge 3: Understanding, sourcing, gathering, managing, and applying the right **market data***

Conquering, or even taming, the market data animal is not an easy task, as the valuation of vanilla and exotic instruments normally requires large amounts of seemingly unrelated data. Sourcing such data is not always the issue, but finding clean, affordable, and easily decipherable data will often require economies of scale. Once the former task is accomplished, then a market data management system must be purchased, or designed and implemented, on the appropriate scale for your pricing requirements. Be ready to evaluate data from leading data aggregators, inter-dealer brokers, and other vendors, on a number of levels, including whether they supply both bid and ask prices, rather than just mid market quotes.

Weigh the costs and benefits of automating a valuation process, including potential loss of control.

*Challenge 4: Understanding, sourcing, and applying the right **analytics** to the right instrument*

While industry standard analytics exist for the valuations of many derivative instruments, off-the-shelf software is rarely inexpensive, and rarely covers all of the instruments in your portfolio. Acquiring, using, or developing software to model various financial derivatives often requires a moderate to deep level of mathematical and/or programming expertise to successfully implement and automate. While spreadsheet solutions are normally "quick and easy", they require maintenance and represent operational risks that must be addressed. If you purchase a large system, make sure its models, methods, and market data assumptions are well documented.

*Challenge 5: Applying the right data to the right analytics, and providing appropriate **disclosures***

This step not only involves the correct combination of data and analytics, but also the correct documentation of the process. The incorrect combination could lead to materially inaccurate valuations. Applying the right data, in the right format, to the right inputs of the right analytics is a science with a sprinkle of art when it comes to tasks such as calibration and curve building, and an experienced quant or financial engineer can be essential here.

A model is only as good as the data that drives it, and an incorrect valuation is often due to bad data usage or model result interpretation rather than inherent short-comings of a particular model. However, one must be very familiar with these short-comings and related assumptions, and include the appropriate disclosures, as outlined in paragraph 32 of Statement 157, for fair value measurements that occur on a recurring basis.

*Challenge 6: **Automation** of the valuation process for consistency and reduced operational risk*

Once the challenges listed above have been met, the process should be automated for portfolios of reasonable size. Even for a small portfolio of derivatives, automating, where possible, the valuation process will save time and reduce operational risk for long term efficiency and valuation consistency. Spreadsheet solutions are useful for prototyping and ad-hoc modeling, but should not be relied upon in a production environment due to operational risks. But ad-hoc spot checks of any automated process are recommended.

There exist many large system vendors whose products perform derivative valuations and handle all of the behind-the-scenes activities to ensure consistency, accuracy, and some level of transparency and auditability. Of course, all solutions come at a cost, and every firm must decide what their appetite is for the tradeoffs between fees and functionality, software and service, in-house and outsourced, and complete solution versus gap filler.

Counterparty valuations or dealer marks are no longer acceptable proxies for unbiased verification of the fair value of a derivative instrument.

Conclusions

While the scheduled effective date of FAS 157 and FAS 159 was for fiscal years beginning after 15-Nov-2007, there were deliberations to extend this date, which would provide vendors and derivative users additional time to comply with these regulations. However, as of 14-Nov-2007 in a news release issued by the FASB, titled *FASB Rejects Deferral of Statement 157 for Financial Assets and Liabilities,* the current date remains in effect "for financial assets and liabilities, as well as for any other assets and liabilities carried at fair value on a recurring basis in financial statements. The Board did, however, provide a one year deferral for the implementation of Statement 157 for other nonfinancial assets and liabilities."

Ultimately, the fair value of an instrument is the price at which the security would be sold for in the market. However, unless a multitude of offers are obtained from independent institutions, even selling a portion of a position may not be indicative of the true price. This may happen in the rare occasion where a handful of investors are involved in buying each others' positions.

There is no myth or magic in Level 1 pricing, and very little opacity in Level 2, but Level 3 mark-to-model results present the most operational and quantitative challenges. Not only do Level 3, and in some instance Level 2, valuations require quantitative expertise to build, buy, test, and apply the correct models and methods, but they also require a requisite depth of knowledge in market data sourcing and management as that data ultimately drives the results of the models. The most important considerations to any valuation include the correct mixture of accuracy, independence, transparency and auditability, consistency, timeliness, and cost-effectiveness.

Just as interest rate swaps were exotic derivatives 10 years ago and are now liquidly traded vanilla instruments, today's exotics will migrate to vanilla status over time. The real challenge is keeping current with the pace of financial instrument innovation, and maintaining a thorough understanding of the assumptions used to model and price derivatives and structured products.

Finally, any valuation measure is underpinned on the assumption of relatively stable and liquid markets. Any major market disruption can lead to dramatic quoted price swings as a result of forced liquidations or irrational investment decisions. In these distressed situations, quoted prices may not reflect the true fair value of a security until a supply and demand equilibrium is reached.

About OTC Val

OTC Valuations Limited is a leading provider of transparent and auditable **valuation and risk reports** for vanilla and exotic derivative securities and structured products. As *Your Trusted Partner*™, OTC Val provides its clients *derivative valuation insights*™ through independent valuations based on validated market data, carefully calibrated models, and proven valuation methodologies. Are you:

- Experiencing **gaps in current processes** with derivative modeling and valuation challenges?
- Seeking **price verifications** and independent fair value insights?
- Having valuation **transparency** issues?
- Having **derivative modeling** challenges?
- Feeling **client, investor, internal risk control,** and **regulatory pressures**, including FAS 157 and IFRS 7?
- **Resource constrained** or burdened by market data costs and integration issues?

WE CAN HELP.

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