



VALUATION RISK REVIEW

**SYSTEMIC ISSUES IN
PRICING & VALUATION**

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INTRODUCTION



Welcome to the inaugural edition of the Valuation Risk Review from Voltaire Advisors. This is the first in what will become a bi-annual publication covering important aspects of the valuation and pricing industry. With our Valuation Risk Handbook also profiling the major vendors involved this segment of the business, the Review will add to our provision of key resources for valuations end users.

We strongly believe that Valuation Risk is central to the financial system in which we all ply our trade. This might not be immediately apparent – certainly if one were to rely solely on the financial or industry press, where it barely merits a mention – but a brief definition will illustrate what I mean.

Valuation Risk is the risk that the value currently placed on an asset held for investment or trading purposes is different to that which would be realized on disposal or maturity. Where this difference is considered to be low, then financial activity can proceed with a degree of confidence. Where the difference is seen to be high, or where the difference - and therefore the risk - is completely unknown, then financial activity grinds to a halt. If valuations cannot be relied upon with some certainty, then traders cease to trade and investors cease to invest.

This is pretty much what happened in 2008, and at least some of the regulatory authorities acknowledged it. Much of the work of the G20 and its institutions since then has been designed to prevent this happening again.

However, it must be emphasised that Valuation Risk is endemic to a global financial system of such sophistication and complexity. It may be a disappointment to policy makers, but Valuation Risk can never be eliminated entirely. Rather, effort should be focused on properly and confidently identifying and quantifying risk. Once it is known, robust measures can be put in place to control and hedge the risk allowing financial activity to continue despite the inevitable uncertainty.

Though endemic, there are undoubtedly aspects of the financial infrastructure today which represent systemic issues in relation to Valuation Risk. This is the theme of Issue 1 of the Valuation Risk Review, and our sections in this issue cover Regulations & Standards, Evaluated Pricing and Models & Analytics.

We hope you enjoy the Valuation Risk Review and welcome any feedback.

Ian Blance

Ian Blance Editor

REGULATION & STANDARDS



Navigating the Regulatory Tsunami

Handling the storm of regulation in the post-crisis financial world

Dealing with the raft of new regulations spawned by the recent financial crisis is probably the most pressing challenge facing financial firms today. Failure to comply results in a painful, expensive and seemingly endless round of sanctions.

Having said that, we have already mentioned the crucial importance of confidence in valuations for the operation of the wider financial system, and the need for an established and accepted set of standards in this field is, we believe, fundamental.

In the last few years there have been a large number of new and revised regulations, guidelines and recommendations governing the practice of financial firms and markets, much of which focuses on the approach to asset pricing and valuation risk. AIFMD, EMIR, CRD IV, MIFID II, UCITS V, IFRS, IVS a veritable alphabet soup of directives.

The review articles in this section cover some of the key regulatory issues currently presenting a challenge to valuation practitioners.

The IVSC outline the efforts being undertaken to establish Global Standards for valuation, and how this intersects with the accounting standards developed under IFRS. As Sir David Tweedie points in the Foreword to this Handbook, much remains to be done.

One of the most well established regulatory regimes in the world is that for US Mutual Funds under the '40 Act'. These laws stipulate a clear requirement for independent, fair valuation of fund holdings, and Deloitte's Fair Value Pricing Survey (now in its twelfth year) sheds light on how funds are dealing with this.

In contrast with the 75-year old '40 Act' the AIFMD - a new oversight regime for Hedge Funds and Private Equity firms - is just a baby, but it has major implications for this burgeoning area of the asset management industry. **KPMG** review the main valuation challenges arising from this Directive.





**International Valuation
Standards Council**

Value Added Why do we need Valuation Standards?

Valuation suffers from being a ‘grudge purchase’. Few people who commission a valuation do so because they want it for its own sake or to appreciate the elegance of the logic on which it is based. Valuation is normally required as a means to an end, for example to justify a transaction or to comply with a regulatory requirement. Too often this has led to a lack of recognition of the importance of the valuation itself and has resulted in a fragmented professional and regulatory landscape when viewed from a global perspective. As a consequence valuation is often misunderstood or misrepresented and certainly underappreciated as a professional discipline. However, proper valuation is an essential component of the global financial system. Among other things it is needed to support investment decisions, for measuring investment performance, as a measurement basis in financial reporting and for complying with capital and other regulatory requirements.

The IVSC’s mission is to establish and maintain effective, high-quality international valuation and professional standards, and to contribute to the development of the global valuation profession, thereby serving the global public interest.

The IVSC is an independent, not-for-profit, private sector organisation. Its membership and supporters consist of over professional bodies from nearly sixty different countries together with firms or organisations that provide valuation services, rely on valuation services or who have any other interest in valuation.

In 2008 the IVSC underwent a restructuring aimed at increasing its independence from the professional bodies that founded it and broadening its remit and support base. One of the changes was to bring financial instrument valuation experts onto the IVSC Standards Board and to set up expert working groups to assist with the development of specific projects in the financial sector.

The IVSC is funded partly by subscriptions paid by its member organisations and partly by donations from its sponsor firms.



THE IVSC

The IVSC was established in the 1980s by a group of professional bodies from the major economies concerned with the valuation of real estate. They all saw benefit in aligning their own valuation standards in the light of increasing cross border investment. Since the turn of the century the roll out of International Financial Reporting Standards around the world has produced a requirement for consistent valuation standards for many other types of asset and liabilities, including business interests, intangible assets and financial instruments. As the demand for valuations, and standards for valuation, has grown so in recent years the IVSC and its agenda have expanded to encompass a much wider range of organisations with an interest in valuation and with expertise and many different types of asset.

Today the IVSC's standards are set by one of two boards, the IVSC Standards Board which issues standards on processes and procedures for valuation practice and the IVSC Professional Board that issues standards for the competency and behaviour of those who provide valuations. The members of these Boards all volunteers appointed by the IVSC Trustees for a fixed term, and are senior practising valuers selected to provide a the necessary spread of expertise and geographic experience.

To assist the Board, expert working groups are often formed to advise on specific projects. Again these working groups consist of volunteers with skills relevant to the project under consideration, and allow the Board access to wider cross section of relevant expertise to ensure that the eventual standard is of the highest possible relevance and quality.

BUILDING REGULATORY PRESSURES

Regulations around valuation fall into two basic types; stipulations on who may value and stipulations on how the valuation is carried out. In some countries there are long established regulations of both types around valuations for mortgage lending on real estate. Recent years have seen increasing regulation around valuations for other purposes as national legislators have reacted to the 2008 crisis. However, much of this regulation is not well coordinated, and frequently presents operational challenges to those who have to prepare the required valuations.

The flow of regulation that concerns or touches valuation shows no sign of abating. For example, the need for robust valuation practices has been highlighted by the FSB in its paper "Key Attributes for Effective Resolution Regimes for Financial Institutions". The increasing adoption of International Financial Reporting Standards around the world coupled with increased audit oversight is also leading to greater regulatory scrutiny of fair value estimates. The international body that coordinates national audit regulators, IFIAR, identified issues around fair value as the biggest single reason for adverse audit findings in its 2012 survey across more than forty countries.

In this context, the development and adoption of global standards for valuation for the major purposes for which valuations are required, and for the major classes of asset, will be of considerable benefit to the global financial system. Apart from helping to build trust and confidence in the valuation process among investors and others who rely on valuations, common standards will reduce the risks associated with national governments and regulators developing inconsistent regulation which in turn will reduce the costs and risks involved with cross border transactions.

Engagement with the regulatory community on valuation issues is therefore very much part of the IVSC's remit and it has regular dialogue with many of the global intergovernmental regulatory organisations such as the Financial Stability Board, the Basel Committee on Banking Supervision and IOSCO. It also engages with regional regulatory authorities, such as those established in the European Union.

WHAT ARE THE INTERNATIONAL VALUATION STANDARDS?

The standards set requirements for the acceptance, undertaking and reporting of valuation assignments. Some core requirements are applicable to most types of asset or valuation purpose, whereas others may vary depending on the purpose for which the valuation is required or the type of asset being valued. The requirements in the standards consist of high level principles in order to enable them to be broadly applicable across different jurisdictions and valuation. The standards set requirements for the acceptance, undertaking and reporting of valuation assignments.



International Valuation
Standards Council

RELATIONSHIP BETWEEN IVSC AND IASB.

Both the IVSC and the IASB have a shared interest in the consistent measurement of fair value for financial reporting. Certain Standards issued by the IASB use fair value as a measurement basis. The IASB has also published IFRS 13 Fair Value Measurement, which sets out the principles for measuring fair value when it is required to be used in other financial reporting Standards. The IVSC issues standards valuation generally and facilitates collaboration and co-operation among its member organisations to help ensure consistent application of those standards.

The IFRS Foundation and the International Valuation Standards Council recently announced a joint statement of protocols for co-operation on the future development of International Financial Reporting Standards (IFRS) and International Valuation Standards (IVS).

The aim of the agreement is to ensure that both organisations are able to co-operate effectively in this important area with each organisation continuing to assume sole responsibility for their Standards.

The statement of protocols:

- captures and recognises the nature of the present and continuing co-operation between the IVSC and the IFRS Foundation in developing standards and guidance on fair value measurement that will support financial statements prepared in accordance with IFRS;
- identifies areas of mutually supportive work that each institution will use its best endeavours to undertake; and
- provides for continued future co-operation between the IVSC, the IASB and the IFRS Foundation.

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To help the consistent application of these principles the standards include non prescriptive guidance. Typically this might include matters that should be considered when preparing a valuation of a specific type of asset or for a particular purpose. While this guidance should be considered were applicable ultimately the decision on which approach to use remains one for the responsible valuer after careful consideration of the material facts.

WHEN DO THE STANDARDS APPLY?

The question often arises as to when the International Valuation Standards are applicable. The role of the IVSC is to create the standards. When they apply is a matter for any party that adopts them, as is any sanction for a breach of the standards. In practice they are most useful where a valuation is likely to be relied upon by a third party or be subject to external scrutiny, such as by a regulator or auditor, and any situation where it is in the public interest that valuations are prepared in accordance with recognised standards.

Projects Relevant to Financial Firms

The IVSC Standards Board currently has a number of projects that involve the valuation of



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financial instruments or which are of interest to financial firms. In each case the objective is to provide information and guidance on the topic that will be relevant and helpful to those preparing valuations and to those receiving them. Providing guidance helps to set parameters for the valuation expert when exercising professional judgment; providing users with an explanation of the basic principles involved in valuations helps improve transparency and understanding, which in turn builds confidence. The guidance the IVSC produces should not be confused with or treated as teaching material – like the rest of the standards it deals with broadly applicable principles and is intended to be practical rather than academic.

Credit/Debit Valuation Adjustments

While the subject of credit and debit valuation adjustments is largely well understood within sell side institutions, many of whom have developed specialised teams on procedures for dealing with the adjustments. However, the advent of IFRS 13 means that the need to reflect own credit risk extends to any entity that holds derivatives and the IVSC guidance is aimed at explaining the principles and main methods used for calculating adjustments. An Exposure Draft of the proposed guidance was issued in late 2013 and following an analysis of the comments received and further discussion with interested parties, the Board expects to finalise and issue its guidance in the third quarter of 2014.

Derivatives Valuation

The Board intends to develop guidance on the valuation of derivatives. It has been decided to break this project down by underlying asset class, and the first paper to be developed is for the valuation of equity derivatives. An exposure draft was issued in July 2013. The feedback received on that has prompted the Board to make a number of changes to the tone and scope of the paper and it is planned to issue a further exposure draft for comment in mid 2014. Once the Board is happy with the general

scope and content of the paper it is intended to start work on similar guidance for other asset classes, ie interest rate, FX, credit and commodity derivatives.

Funding Valuation Adjustments

The issue of funding valuation adjustments has come to the fore in the last few years as banks have started to reflect the cost of funding uncollateralised positions, which was not generally reflected in the various methods used for valuing positions that used a risk free rate. However, there is significant controversy as to how and when this adjustment should be reflected. Some argue that making such adjustments to valuations appearing in financial statements is incompatible with the concept of fair value as defined under IFRS and US GAAP. Others believe there is scope for overlap and double counting with debit valuation adjustments. The Board has agreed a project to develop guidance around this topic and will be forming an expert group in the summer of 2014.

Valuations for Recovery

Financial regulators around the world are looking to align their regimes for the resolution and recovery of financial institutions in order to alleviate the “too big to fail” threat that was a feature of the 2008 crisis. In 2011 the FSB issued a paper “Key Attributes of Effective Resolution Regimes for Financial Institutions” that identifies that provisions for the valuation of an that assets of an institution in financial difficulty is an important element of any resolution regime. Prompted by the above and the lack of any internationally recognised valuation standards to support the recovery of any corporate entity, the Board has agreed a project to develop a standard to sit alongside its existing standards on valuations for financial reporting and valuations for secured lending. While not exclusively focussed on the financial sector, it is envisaged that a major part of the project will be to consider the valuation requirements that are appropriate under the emerging resolution regimes in the sector.



Fair Value Pricing Survey, Twelfth Edition Positioning for the future

By **Paul Kraft**, U.S. Mutual Fund &
Investment Adviser Practice Leader

EXECUTIVE SUMMARY

Governance, use of market data, and risk top the agenda for 2014 survey participants

In the aftermath of the enforcement action against an investment company's Board of Directors and related settlement, the mutual fund industry enjoyed a comparatively quiet year on the valuation front without any formal valuation guidance issued by the U.S. Securities and Exchange Commission (SEC). The lone exception came as our survey was closing in July, when the Money Market Fund Rule (the Money Rule)¹ referenced several aspects of valuation and fund governance.

Up until then, the relative calm had as much to do with the market's persistent rise as it did to the lack of SEC activity or another high-profile enforcement case. The Standard & Poor's 500 Index ended 2013 up 30 percent, and it has enjoyed mostly smooth sailing again this year. Fixed income markets have participated in the rally as well, owing to supportive easy-money policies enacted by global central banks. Perhaps the best gauge of the current even-keel environment rests in the Chicago Board Options Exchange Market's Volatility Index — or the "VIX" — which has remained extremely muted by historical standards.

Investment managers and Boards took the opportunity to continue to evaluate and enhance their valuation process.

Also, the kinds of "black swan" events that created valuation challenges in recent years — such as the Japanese typhoon or U.S. debt downgrade that roiled the markets in recent years — have mercifully dissipated. To be sure, there was no lack of headlines over the past 12 months, as the geopolitical landscape was rife with potential macro-economic landmines such as the turmoil in Ukraine, the emergence of ISIS in Iraq and Syria, and the economic slowdown

92

mutual fund
groups

participated in our
twelfth Fair Value
Pricing Survey

74%

of survey
participants

indicated that they
had revised their
valuation policies
and procedures over
the last year



in Europe. But, nearly without fail, the markets shrugged off these developments in the main, sending assets to record heights. Nonetheless, no one would argue that the valuation process has become any easier. The responsibility of mutual fund groups to determine what they believe best reflects fair value for every investment has not changed, and the fundamental responsibilities of their Boards relative to valuation have likewise not lessened. What is different is the increased availability and interest in market data, transparency tools, automation and technological solutions, all of which allow mutual fund groups to do more in the same or perhaps even less time than before, resulting in more compelling analytics and data to support their decisions.

Against this backdrop, 92 mutual fund groups participated in our twelfth Fair Value Pricing Survey. The findings demonstrate that fair valuation remains a “top of mind” issue for investment managers, Boards and their stakeholders. To no surprise, change was the “name of the game” as 74 percent of the survey participants indicated that they had revised their valuation policies and procedures over the last year, finding opportunity to evaluate and enhance their valuation processes. The most common changes related to the addition of specific procedures for certain investment types, changes to pricing sources, and enhancing language or details for certain hard-to-value investments. The percentage of mutual fund groups using a zero trigger in fair valuing foreign equities continued to grow as well, reaching nearly 50 percent, the highest level attained since we started the survey. Other survey participants continue to use the key valuation indicators — S&P 500 and/or Russell 1000, combined with thresholds, i.e., 50 basis points — to identify whether to make an adjustment to the closing exchange price of their foreign equity holdings.

BOARD GOVERNANCE

The SEC surprised many people this year by issuing valuation guidance in July; only 5 percent of those participating in the survey actually expected the SEC to make such a move in 2014. What was surprising about the guidance was not only that it was issued at all but also where it was housed, within the Money Rule. We all anticipated that the SEC would

speak about the need to fair value money market fund holdings instead of using amortized cost, and it was anticipated that there would be some guidance suggesting how often shadow pricing should be performed. However, the SEC’s comments on what non-money market funds using amortized costs for securities (with 60 days or less until maturity) were expected to consider each day was not anticipated, nor was the re-emphasis of the role of the board in considering how pricing vendors value investments.

Before then, the most recent SEC activity directed at boards was the enforcement action that settled in 2013. With that development as context, the 2014 survey asked questions designed to assess whether Boards had made changes to their oversight activities, and we noted the largest changes in the following areas:

- **Forty percent of survey participants said they have changed the types of valuation materials provided to the Board, compared to 54 percent a year earlier.**
- **Thirty-nine percent of survey participants have changed the level of detail in the valuation materials provided to the**

Board, compared to 57 percent a year ago. Knowing exactly what to receive and when to receive it is not always easy, as some materials are probably not necessary in all circumstances. One of the emerging trends in this year’s survey that we noted was that 9 percent of survey participants indicated that the Board added valuation risk dashboards or key valuation indicators (KVIs) over the last year to assist in their oversight of the valuation process. Given the judgment required in knowing what reports are needed, and the regulatory guidance around the need for “continuous monitoring,” we can envision Boards using tools like these more often in the future as a risk-intelligent way to determine when the environment has changed, when the level of price uncertainty is higher for a particular asset class, when Boards might want to increase their level of involvement, and what information they will need to receive to effectively do so.

USE OF MARKET DATA

The price challenge process has long been an area of discussion in our surveys as it is a highly



judgmental area and one where potential conflicts of interest often can arise. The process also calls for strong controls to ensure that management bias does not play into the valuation process. Mutual fund groups have long debated and executed price challenges based on market data and secondary vendor price comparisons, as well as news and events specific to the market, industry, and issuer.

However, there is little debate that a well-supported price challenge should include such market data. This allows the evaluated pricing provider to challenge its valuation process and determine whether relevant market data was considered as part of its evaluated price determination. Survey participants seem to agree, as 54 percent indicated that they challenge a price only when they have conflicting market data that would suggest the price is not accurate. This response seems to be aligned with the emergence of pricing transparency tools that enable mutual fund groups to study the inputs and market data behind an evaluated price.

In addition, there has been plenty of discussion as to the appropriate amount of documentation required of an affirmed price challenge by the pricing vendor. To this end, 41 percent responded that they document the nature of the pricing challenge and note that the pricing vendor affirmed its evaluation, and 43 percent answered that, upon receiving an affirmation, they reach back out to the initiating source, discuss the results of the challenge, and conclude thereafter.

Finally, similar to the prior year's survey, 73 percent indicated that they may change the price if they feel it is inaccurate even if they do not hear back from the pricing vendor. This supports the use of market data as a trend, at least as far as the data helps mutual fund groups go beyond the pricing challenge process and contest the need for certain secondary source comparisons.

It is also supporting determinations regarding the risk associated with valuations where little market data exists to support the underlying evaluation.

VALUATION RISK MANAGEMENT

The formalization of risk oversight continues to be a maturing trend, with 59 percent of the fund groups indicating that they now have a risk function. Also, as noted in prior surveys, valuation as an enterprise risk has continued to take root. In this year's survey, 48 percent of mutual fund groups identified risks associated with the valuation of certain investment types as part of their formal Rule 38A-1 or enterprise risk assessment process, compared to 51 percent in the prior year. Overwhelmingly, 95 percent of those survey participants have identified internal controls to manage the valuation risk, and 57 percent have identified valuation of portfolio investments within the risk charter and the related price challenge process as a valuation risk.

With valuation risk increasingly on funds' radar screens, KVIs may have broader potential applications than just in the Board room, as management can use them to help determine where the greatest risks exist and on which asset classes to focus precious time and effort. Ultimately, KVIs help identify when potential risks surface as real issues, and, in their ideal state, can highlight potential risk areas before they lead to a "code red" event.

Therefore, risk-based tools in the valuation process may be an upcoming trend. One notable finding is the 20 percent of survey participants who had developed risk management assessments — such as asset and stress test liquidity tests, consistent with the SEC's January 2014 guidance (No. 2014-1)² — and used the results as part of their valuation process.

² <http://www.sec.gov/divisions/investment/guidance/im-guidance-2014-1.pdf>

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LOOKING AHEAD

Whether more risk-based metrics and tools will be incorporated into the valuation process in the future is yet to be seen, but we do know that regulatory risk has prompted perennial change for the industry when it comes to valuation issues. In the year to come, certain matters on the regulatory front bear monitoring:

1

Pricing vendor oversight

The SEC's comments in the Money Rule relating to Board consideration of pricing vendors may result in increased Board activities in this area or the development of greater linkages to how the Board performs its required duties. The guidance may also create an increased focus on evaluating whether or not prices of securities for both domestic and foreign investments (not just equities) are as of 4 p.m. EST, as the SEC specifically noted that Boards should consider how close the price is determined to the time that the mutual fund calculates its NAV per share.

2

Short-term debt valuation

The Money Rule also emphasized the need for fund management to ensure that it takes measures to assess whether amortized cost approximates fair value each day that it uses such a measure to value a security, even for non-money market funds. This may spawn more concrete procedures and documentation to demonstrate such, or, alternately, result in a movement away from amortized cost for such investments.

3

Alternatives sweep exams

During the year, the SEC's Office of Compliance, Inspections and Examinations conducted sweep exams focused on the use of alternative investments (e.g., derivatives, leverage) in the mutual fund industry. Clearly, the findings from these sweep exams could put added expectations on mutual fund groups and Boards to continue to elevate the bar for valuation processes.

4

Private equity valuation

Some mutual funds hold a small portion of their assets in private equity investments or other investments that are illiquid, and valuation can often be challenging because it requires considerable judgment coupled with a lack of public information. The SEC's examination of private equity fund managers led to comments in various articles and speeches over the past year regarding the valuation of private equity investments, such as the following remarks made at a forum in 2014³:

"Some of you may be under the mistaken impression that when our exams focus on valuation, our aim is to second-guess your assessment of the value of the portfolio companies that your funds own ... to challenge that a portfolio company is not worth X, but X minus 3%. We are not, except in instances where the adviser's valuation is clearly erroneous.

Rather, our aim and our exams are much more focused. Because investors and their consultants and attorneys are relying on the valuation methodology that an adviser promises to employ, OCIE examiners are

³ <http://www.sec.gov/News/Speech/Detail/Speech/1370541735361>



scrutinizing whether the actual valuation process aligns with the process that an adviser has promised to investors. Some things our examiners are watching out for are:

- Cherry-picking comparables or adding back inappropriate items to EBITDA — especially costs that are recurring and persist even after a strategic sale — if there are not rational reasons for the changes, and/or if there are not sufficient disclosures to alert investors.*
- Changing the valuation methodology from period to period without additional disclosure — even if such actions fit into a broadly defined valuation policy — unless there's a logical purpose for the change."*

Although these comments were clearly directed at the private equity fund industry, it is possible that the SEC could apply them to those mutual funds holding private investments with valuations significant enough to affect the NAV per share of the fund. Such an outcome could lead to the need to evaluate the current disclosures in the prospectus and in shareholder reports.

Regulatory risk is not the only driver of potential change. In an environment where more data continues to become available, the ability to do more with it in less time is emerging as a differentiating strategy. The survey results continue to show that mutual fund groups are making changes in how they use data in their valuation process, as approximately 50 percent of survey participants either increased automation in the valuation process over the past year and/or conducted a study designed to find efficiencies in the valuation process. This finding is significant in that it shows mutual fund groups realize the need to continue to evolve so they can become more nimble. Finding a way to do so while still being risk conscious may be a difficult but important challenge.

All of us know that being able to understand the risks present when a crisis hits, as well as the exposure to them, is a critical capability for weathering the storm as quickly and efficiently as possible. Six years may seem like yesterday, but that is exactly how long it has been since the credit crisis of 2008, and no one has forgotten how difficult valuations were to assess during that time.

While the fact that the last two significant economic downturns have occurred within about six years of each other does not necessarily mean another downturn is around the corner, it does serve to remind us of the importance of being prepared — taking care to evaluate the inputs in the valuation process and determining which ones might be most subject to volatility in a troubled market; revitalizing due diligence on brokers that may be able to supply prices on valuations where needed; revising internal controls relating to manual processes; and strategically making use of the technology available to assist in the valuation process.

Most importantly, fund groups need to always have one eye on the rear view mirror and consider the valuation lessons learned from 2008 and other circumstances marked by limited liquidity and market data. Valuation during times of relative calm is complex enough. When conditions are less than ideal and hidden risks may surface, being prepared is the best antidote.



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KEY FINDINGS

We have summarized below certain noteworthy survey results for three subject areas: policies and procedures, pricing sources, and specific investment type fair value considerations.

Policies and procedures

- Similar to last year, 76 percent of survey participants have regularly scheduled dates, most commonly on an annual basis, at which valuation policies and procedures are updated.
- Survey participants noted that day-over-day tolerance checks looking for large price movements/fluctuations and vendor-to-vendor comparisons (i.e., primary-to-secondary sources) were the most effective internal controls to detect a situation in which a price needs to be changed.
- Fifty-four percent of survey participants indicated that the front office is responsible for notifying the fund accounting department or management of any market- or issue-specific events that have occurred and may affect pricing.

Pricing sources

- In one emerging practice, 54 percent of survey participants indicated that they only challenge a price when they have conflicting market data suggesting that a price is not accurate. In the current survey, 23 percent indicated that they challenge a price each time or on certain instances when it exceeds a specific threshold, down from 55 percent in last year's survey.
- Twenty-seven percent of survey participants indicated that they challenge secondary pricing vendors as part of their regular valuation process just as they do primary pricing vendors.

Fair value considerations for specific investment types

Equities

- Seventy-nine percent of survey participants each day compare equity prices received from the primary pricing source against those from a secondary source, which is consistent with the prior year.
- The S&P 500 Index (either directly or through the use of S&P 500 futures contracts) remains the most common proxy used to identify situations in which the closing price for equities trading on foreign exchanges may require adjustment.

Fixed income

- Fifty-two percent of survey participants use bid pricing exclusively.
- Depending on the asset class, between 29 percent and 40 percent of survey participants indicated that they compare daily fixed income prices received from their primary pricing source to a secondary source, which is similar to that noted in the prior year.

Derivative contracts

- Eighty-seven survey participants determine valuations for interest rate swaps based primarily on prices obtained from a pricing vendor; 91 percent used such prices for determining credit default swap valuations.

Illiquid securities

- Seventeen percent of survey participants with private equity investments indicated that they always or normally use multiple methodologies to value such investments.
- On the day of a halt or delisting, 62 percent of survey participants use the most recently traded price without adjustment, if no specific information relating to the halt or delisting is available.



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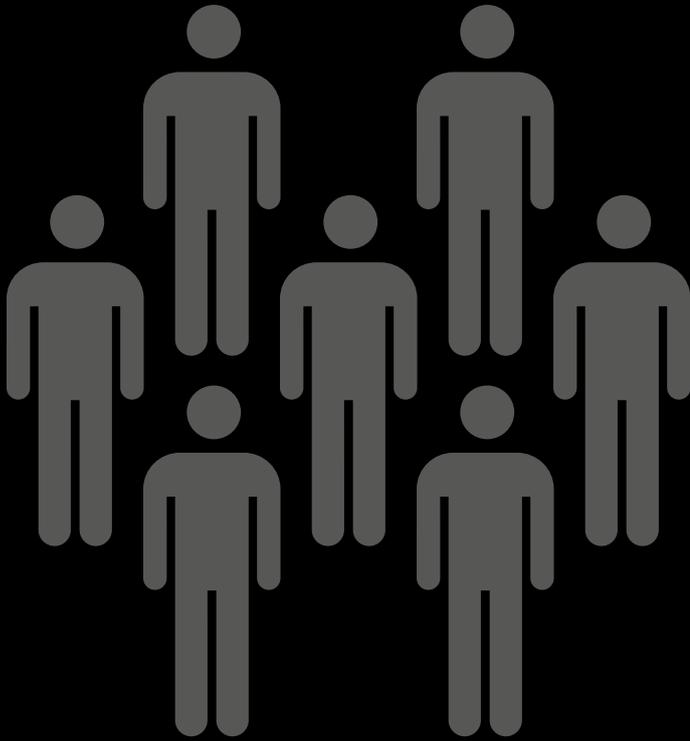
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AIFMD: Prepare for takeoff

By **Doug McPhee**, Global Head of Valuation Services at KPMG and Member of the International Valuation Standards Council's Professional Board and **Matthew Warren**, Director and AIFMD subject matter expert for Valuations at KPMG in the UK.

When the European Commission introduced the Alternative Investment Fund Managers Directive (AIFMD), it drafted one of the most ambitious and complex regulatory reform agendas ever introduced into the asset management industry.

Amongst many reforms, the Directive provides a detailed valuation framework, including requirements for detailed valuation policy and procedures to be applied consistently across all alternative investment funds (AIFs) and requirements for competence and independence of personnel performing valuation functions. This requires close attention by Alternative Investment Fund Managers (AIFMs).

There are a number of challenges AIFMs face in order to satisfy the Directive on valuation. Here we focus on some of the more pressing areas that will impact AIFMs.

INDEPENDENT VALUATION

AIFMs are required to ensure that the valuation function pertaining to the investments they manage on behalf of investors is carried out impartially and with skill, care and diligence, either by an independent external valuer or by the AIFM itself.

The requirement for impartiality brings challenges for AIFMs. For instance, for AIFMs undertaking valuations internally, the Directive requires that those responsible for valuation be independent from portfolio management teams, yet have equivalent knowledge, experience and level in management hierarchy as those in portfolio management in order to appropriately challenge key valuation matters.



This relates to both those overseeing the valuation function and undertaking valuation analyses. As such, “lending” staff from portfolio management to an internal valuation function will most likely be challenged by regulators. For many AIFMs, building an independent valuation function with the requisite knowledge of the underlying investments will be challenging. This will be increasingly challenging for AIFMs that do not readily have a larger pool of sufficiently experienced resource.

Regulators may also require that an external valuer verify the independence of the internal valuation function and an AIFM may wish to include such confirmations in its regulatory submissions.

An AIFM could alternatively appoint an external valuer (which has no link to the portfolio management function of the AIFM or the AIF, and is not appointed by the portfolio managers) to undertake the valuation function. Whilst the appointment of an external valuer will not affect an AIFM's liability to an AIF, the external valuer will be liable to the AIFM for any losses suffered by the AIFM as a result of the external valuer's negligence or intentional failure to perform its tasks.

VALUATION POLICIES AND PROCEDURES

For each AIF it manages, an AIFM must establish, maintain, implement and review Valuation Policies and Procedures (VP&Ps) that ensure sound, transparent, comprehensive and appropriately documented valuation processes. VP&Ps should include:

- The AIF's investment strategy and assets it may invest in;
- The valuation methodologies used for each asset type and the selection process for each methodology;
- Obligations, roles and responsibilities of all parties in the valuation process (including external valuers);
- Details of the competence and independence of those doing the valuations; and
- Escalation channels for resolving issues in asset values.

VP&Ps should be reviewed at least annually and, in any event, before an AIF engages in a new asset type. An AIF may not invest in a particular asset type before a valuation methodology for that asset type has been included in the VP&Ps.

The AIFM's risk management function should review the VP&Ps and senior management should review and approve all VP&P changes.

AIFMs also need to implement sufficient governance to ensure that there is no disconnect between the documentation and implementation of the VP&Ps.

USE OF VALUATION MODELS

AIFMD requires that the main features of all valuation models be documented in the VP&Ps. Before being applied, a model must be validated by a competent and experienced person who has not been involved in building the model and be approved by senior AIFM management. Again, the regulator may require an independent audit on applied models.

This presents potential challenges for AIFMs, particularly when investing in more illiquid assets where bespoke and complex models are developed that evolve over time.

As such, AIFMs will need to ensure there is sufficient governance around model validation, update procedures, version controls and documentation.

WHAT QUESTIONS SHOULD AIFMS BE ASKING?

If you have not already done so, there are a number of valuation-related questions that AIFMs should be considering now:

- If performing valuations internally:
 - Do we have sufficient qualified individuals that are separate to portfolio management in order to deliver impartial valuations?
 - Do we have sufficient governance to support the delivery of objective valuations?
- If using an external valuer:
 - Have we performed the necessary diligence on external valuers to be satisfied of their competence?



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- Are there sufficient information transfer and governance processes in place to ensure an efficient process?
- Have we ensured that the external valuer does not delegate any of the valuation work to a third party?
- Do we have sufficient governance structures around proprietary valuation models (particularly model validation, version control and model updates)?
- Do our VP&Ps contain sufficient detail and are we putting our VP&Ps into practice?

WHAT SHOULD I DO NEXT?

AIFMs that have not already conducted an in-depth AIFM impact and readiness assessment should do so without delay. The timelines to compliance are increasingly short and by undertaking such an assessment, AIFMs will get a better sense of the implications and the scope of the work that needs to be done in order to not only comply with the Directive, but to maintain long-term profitability under these new rules.

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cutting through complexity

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Companies seek valuations for corporate governance or regulatory reasons, or because management wants to better understand value so it can make optimal decisions. In these instances, a company is often at a critical juncture – it may be planning an acquisition, resolving a shareholder or joint venture dispute, or seeking to reduce the gap between intrinsic and market value. At such a strategic time, it makes sense to seek the services of an experienced commercial valuations team.

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EVALUATED PRICING

Mark to Market?

Evaluated pricing in an era of declining liquidity and increased transparency

In August, Ian Blance, Managing Director of Voltaire Advisors, engaged with a number of senior professionals from leading providers of evaluated pricing and data management to get their views on key issues in this part of the industry.



Jayme Fagas has been the Global Head of Valuations and Transparency services with Thomson Reuters' Pricing and Reference Services (PRS) business since January 2014. Prior to this role Jayme was the Global Head of Evaluated Pricing with Thomson Reuters former Enterprise Content sector. Ms. Fagas brings significant expertise to the Thomson Reuters having worked in evaluations, trading and analytics at a number of major Wall Street firms and has been a pivotal driver in transforming the evaluated pricing market. Jayme has over 28 years valued experience within the global financial industry.



Devendra Bhudia, is Vice President Product Manager for GoldenSource and was appointed in 2008. His responsibilities include providing thought leadership for the GoldenSource data management platform. Dev's career spans more than 15 years during which he has gained considerable experience within the data management arena for the financial services sector. Dev has been involved in the architecture development of the GoldenSource 360 EDM platform, and future product roadmaps.

Prior to joining GoldenSource, Dev spent 3 years working as a specialist Data Warehouse Consultant in New York for clients including Merrill Lynch and CIBC.



THE RESULTS OF THIS EXTENSIVE AND DETAILED Q&A SESSION ARE RECORDED HERE.

IB - Evaluated pricing is an increasingly important method for valuing securities. When is it most appropriate to use this technique?

Jayme Fagas (JF) - Independent, evaluated pricing is useful in many aspects at the Financial Institution. The typical customer uses an independent, evaluated price to mark their positions at end of day, to strike NAV, as an input for risk assessment and as a critical part of meeting regulatory requirements.

Evaluated pricing sits at the heart of fair value measurement and leveling - the breadth and depth of an evaluated price allows for accurate fair value measurement. The evaluated price must, of course, offer transparency and full insight into the methodology used to derive the price. This allows for more streamlined portfolio valuation and regulatory compliance. Transparent, evaluated pricing offers clear insight into the instrument value and can reduce risk exposure with confidence and efficiency.

Devendra Bhudia (DB) - Evaluated pricing is one of a variety of methods useful in ascribing a value to securities which do not trade on a regular basis, if at all. It is most appropriately used when trade prices or market quotes are unavailable or 'stale' - i.e. have not updated for a material period of time.

Having said that, this method should still be treated with a degree of caution. By definition, the technique does not represent a market price, and the fact that there is an element of judgement involved (usually from an analyst or evaluator) needs to be taken into consideration.- what is the DM angle?

GoldenSource has the ability to integrate with evaluated pricing services like IDC, Bloomberg, Thomson Reuters etc.... This allows the transparency to be kept against the price in a way that it can be tracked and reported against.

IB - The inputs used in pricing models are in a state of flux at the moment, with price discovery from market makers drying up. How are evaluated pricing providers meeting these challenges?

JF - Access to market observable inputs is critical to the evaluated pricing process and often, market color and data can be difficult to source. Providers must continue to look to find

market color from new sources. The new issue market often provides insight into trading levels. Issuer curves and sector curves are also an important source of information. Contributions from an existing network of customers are extremely useful. A highly interactive challenge process which has customers directly interfacing with evaluators is always a very good source of feedback and market color. One cannot underestimate this type of challenge process! Lastly, process and procedure must be followed to ensure consistency and accuracy.

DB - This is an important issue. The essential feature of evaluated pricing is to use inputs from the liquid, traded market to determine, by extrapolation, the value of related securities in the illiquid, non-traded market. If the data from the liquid sector is reduced, or less easily available (say, by market makers being reluctant to reveal bid-offer quotes) then the quality of the price derived from this is likely to be lower.

There are ways to address this. Trading activity on electronic platforms could go some way to replacing dealer inventory, but this development is still in its early stages. There are a large number of such platforms currently in play and it is by no means certain which, if any, will gain traction and market share and therefore survive. Trade reporting to CCPs is also important in this respect.

At the end of the day, though, if secondary market liquidity declines then the availability of key inputs to the evaluated pricing process will be compromised.

IB - Transparency of the valuation process is increasingly required by users. What is the best way of delivering this? What should be included?

JF - Transparency requirements are not explicitly defined and often differ from client to client. Differences also arise based on instrument type. Any and all data that offers clear insight into how a price was derived must be made available with the evaluated price. Derived analytics and assumptions should also be made available. Clients may not opt to take everything but, we make all the data available. Data should be available in bulk and at the instrument level for a deep dive if needed.

Efficient consumption and use of the now required large volumes of data present new challenges. We are delighted to provide our customers with Thomson Reuters Valuation Navigator, an advanced solution that transforms their valuations workflow for better efficiency and accuracy. In developing Thomson Reuters Valuation Navigator, our goal was to work closely with our customers to develop a solution that empowers them to improve transparency and compliance in response to heightened global regulatory standards.

DB - That is a good question. Transparency has been a mantra for everyone in the industry for so long that we have possibly forgotten what it means! The regulators would say reveal everything, but if vendors did this what would users do with it?

To understand some of the more complex aspects of transparency - understanding how certain models work, for instance - would require a high level of quantitative skill and training which very few people in the process possess. So, in our view, transparency needs to be delivered at the right level to be useful to the receiver, otherwise it is meaningless.

Good data management tools have a role to play here. Transparency data filtered through sophisticated business rules can often be better understood at the operational level. If a market data management system did some of the heavy lifting in terms of identifying and highlighting outliers and exceptions, then the user experience will be much more effective. The main point here is each organisation will have some way to price the assets, but they price chosen must be defensible. It must be very clear on how the price came about, what validations were run and who contributed to it, from a pricing vendor to an actual person maintain the price if it was adjusted for any reason.

It's not just the price that needs to be audited and made transparent but also the rules need to be audited and transparent. This needs to be evidenced. We are now also seeing the data vendors providing data which provide commentary around the prices themselves e.g TR transparency fields and BB HQLA.

IB - What other supporting information should an evaluated pricing vendor provide to its clients?

JF - Again, offering all data which supports and offers greater insight into the evaluated price and the methodology used must be provided with the price. Assumptions and derived analytics add even more transparency.

DB - We have already highlighted the inherently subjective nature of evaluated pricing, so the key information that a vendor needs to supply to its clients relates to this issue. We believe that the vendor needs to make it completely clear - transparent, even - how much judgement was deployed in coming up with a price.

There are a number of ways that this can be done, including revealing the number and quality of any market quotes which went into the evaluation, indicating the frequency and timeliness of these and noting when there has been a period without any market data to calibrate the evaluation model.

A robust price challenge process is also essential. In the event that a user identifies a material exception between the evaluated price and another source, it is incumbent on the vendor to justify their levels if their evaluation is to be credible.

IB - What are the main asset class challenges for evaluated pricing today?

JF - Harder to value asset types like CLO's, complex derivatives and structured notes are always a challenge. Their illiquid nature means that ample market color and data may not always be available. Highly quantitative pricing methodologies are often required. Stricter regulations demand more transparency and with complex instruments this is often difficult.

DB - GoldenSource deal with many and varied asset classes, and all of them are fully supported. Even managing exchange traded equities requires the same level of governance and data linages

Looking at evaluated pricing however, we see particular issues in the market with derivatives, structured products and complex mortgage related securities. For these security types there are fewer vendors available, meaning that clients are reliant on a much smaller quorum of sources. In such circumstances, good data management and exception handling is more important than ever, and transparency is mission critical.

IB - What does the future hold for evaluated pricing? What should we be looking out for in the next 3-5 years?

JF - Increased transparency requirements should be expected. Understanding the real value of instrument is critical and this is only accomplished with clear insight into a price. A need for tools which support customers in sorting through the massive "sea" of pricing data will continue to rise.

IB - What does the future hold for evaluated pricing? What should we be looking out for in the next 3-5 years?

JF - As data requirements increase, tools which add efficiency and offer easier ways to make sense of the data will be invaluable.

DB - GoldenSource work with a number of evaluated pricing providers, so we are in a good position to take a high level view on this industry segment. Our view is that, whilst the market is dominated by the traditional large data vendors, technological developments will allow smaller, niche firms to develop. The existence of data management platforms such as ours will encourage this trend, since clients will be able to view these specialist shops alongside prices from other sources without having the laboriously program a new feed.

This is good for the end user since it created a more competitive environment and gives them more choice and back-up. It will also potentially drive down data costs.







Buy-Side Price Validation: Tackling the New Pricing Challenges

By **Devendra Bhudia**, Vice President Product Manager,
GoldenSource

Asset managers have tackled pricing issues for years. But what they haven't faced – until now – is a minefield of thinly-traded markets and unprecedented regulatory scrutiny. While the subject of pricing isn't new, it has never been more explosive – and the old way of running processes is being put to the test.

This latest wave of pricing pressure on the buy-side is being driven by the likes of the International Financial Reporting Standards (IFRS) for accounting, which place tougher requirements on how complex derivatives are valued. Likewise, AIFMD, EMIR, Solvency II, and Dodd-Frank provisions are all putting transparency at the heart of the valuation process. This is very much on the regulatory radar, with comment letters from both the FCA and SEC in recent years, warning of the risks associated with outsourcing functions which are critical to regulated activities – which certainly includes valuations.

Indeed the problem of valuation has worsened recently in the bonds markets, following a period of shrinking liquidity. With new capital rules prompting investment banks to reduce or even quit trading in fixed income, traditional sources of pricing from bank inventory have dried up.

This is why asset managers are reviewing how they establish valuations, and the level of diligence they apply to third party sources. As such, price validation is firmly in the spotlight.

THE HIGH PRICE FOR ERRORS

Compliance, however, is only part of the story. Accurate valuations drive accurate net asset value (NAV) for funds. The consequences of getting these wrong are severe: mistakes affect purchase and redemption transactions and cause mis-statements of fund performance.



The operational effects are clearly problematic, but it is the reputational ramifications that are perhaps the most concerning and far-reaching. In the U.S, highly publicized mutual fund NAV errors have illustrated how considerable, and sometimes irreversible, reputational damage can be.

While many of these issues are not new, investor awareness of valuation issues exposed during the credit crisis has created a more urgent need for asset managers to look for accurate pricing. The problem is that coming up with an accurate valuation is no easy task.

INDEPENDENT ARBITRATION

This is why robust price validation is essential. It requires asset managers to access multiple evaluated price feeds from various external sources in order to analyze, compare and determine their own price. Price validation is also needed to ensure that any prices arriving

through a data vendor, broker, or evaluated pricing supplier are reasonable and complete.

In the past, it may have been acceptable to rely on a single third-party source for pricing, but that's certainly not the case in today's compliance heavy landscape. Gathering data from just one vendor means there is no way of verifying the reliability of that source. Instead, the asset manager has to trust the feed completely, which carries a significant level of risk.

While some firms have built spreadsheets and manual processes to plug the gaps, these don't deliver the consistency and transparency regulators and investors demand. It is up to the asset manager to evaluate feeds independently, for both easy- and hard-to-value instruments. Above all, asset managers need to be able to defend and justify the prices they place on their asset holdings, with an appropriate audit trail to fall back on when questions get asked.

CASE STUDY: ILLIQUID BOND PRICING

For some fund managers, the solution to pricing illiquid bonds is to use a single provider for evaluated prices. This is increasingly seen by regulators as a major dependency and source of valuation risk. They would much prefer to see this risk mitigated by the use of multiple sources.

The pricing of fixed income investments has been subject to major strain over the last few years. During the financial crisis which blew up in 2008, some sources for bond pricing were found wanting.

For one, liquidity has dried up. Investment banks have reduced their involvement in fixed income trading under tough new capital rules. As a consequence, the use of broker quotes for illiquid bonds – previously a common approach – has become more difficult with the reduction in inventory.

At the same time, the fixed income instruments that managers invest in have become increasingly complex. This comes from the growing use of sophisticated hedging strategies and the desire to attract more institutional money through higher-yielding assets.

While the nature of the bond markets and investing has dramatically changed, valuation practices have remained relatively simplistic and often overly reliant on a single source.

This unhealthy attachment to a single source is coming under scrutiny by regulators for multiple reasons.

Fund managers often have to strike daily NAVs for instruments like municipal bonds that go untraded for days or even weeks – in other words, they have to mark-to-market without a market. Managers who rely on one source of pricing for this inevitably expose themselves to the strengths and weaknesses of the evaluated pricing service they choose. Poor data affects daily calculations, ranging across net asset values, performance, portfolio weightings, and exposures.

In addition, after several blow-ups involving esoteric valuation models, new regulations such as AIFMD, EMIR, Dodd-Frank and Solvency II are forcing more managers to be much more transparent about pricing. These managers are required to show precisely where they derived their models from, which



CASE STUDY: ILLIQUID BOND PRICING *(CONTINUED)*

market data sets are being used as inputs, and whether assumptions regarding default risk, interest payments, and prices are grounded in reality.

Because of these risks and others such as concentration, regulators are pushing managers to end their dependency on limited sources for pricing data. They want managers to implement their own due diligence on their vendors through independent verification across sources.

For fund managers, healthier pricing practices include:

- Sourcing different prices from a variety of sources
- Collating, ranking and defining those prices in a central place where records can be audited easily – not in spreadsheets
- Applying business rules to detect issues before they occur and demonstrate responsibility in decision-making

Given the complexity of the market and the persistent scrutiny of regulators, smart fund managers are seeing that it's time to address these issues.

CASE STUDY: FX PRICING

From the EU extending sanctions on Russia to China devaluing the Yuan, there is no shortage of events affecting a fund manager's investment strategy. But in the midst of such volatility, the priority for any fund manager remains the same: deliver absolute returns in an increasingly competitive, intricate and highly regulated market.

It's no secret that one of the keys to achieving this is managing high levels of pricing risk across FX and certain fund managers will be aiming to alter their positions – at the same time as keeping a large exposure to their base currency. While fluctuations in currencies such as the USD and GBP are reasonably predictable, funds that manage a base currency of say the Russian Ruble (RUB) are exposed to greater uncertainty.

A highly volatile base currency can elicit an excessive amount of risk, which presents a

serious challenge for a risk manager who must anticipate the future in order to hedge against exposure. While risk managers may have stress testing processes in place, this won't fully illustrate how their exposure is affected by increasing currency volumes. Formulating accurate prices as volumes rise in order to better understand exposure is critical to better managing this risk and a key challenge for firms to address.

With this in mind, certain fund managers have taken the approach of building spreadsheets and relying on manpower to analyse high volumes of data. Unfortunately, this strategy ultimately results in less accurate prices. Consequently, fund managers have begun to seek an alternative – one that not only allows a third party to cleanse data for more accurate prices, but also to manage the infrastructure. It's easy to see why, as with pressure to reduce bottom line costs; no fund manager wants to shoulder the burden alone.



CASE STUDY: FX PRICING (CONTINUED)

For fund managers with a volatile base currency, relying on people intervention is a risk – particularly in today’s market. However, for those that adopt the third party route, unpredictability could translate as opportunity. Selecting this approach should

lay the platform for better fund performance which means higher revenues. In this risk-conscious world, having strong foundations is the first step on the road to delivering those all-important returns for investors.

CONCLUSION: REDEFINING THE RULES

In order to validate the consistency and defensibility of price sources, asset managers need an approach that seamlessly connects to third party sources and applies sophisticated, pre-defined rules to compare feeds. This would allow them to remove speculation and, instead, arbitrate multiple prices in an unbiased way.

The degree of sophistication of these rules can be crucial, particularly for intricate OTC instruments and very thinly-traded bonds. Every input and assumption for evaluated pricing models must be documented and tracked, and wherever possible several vendor feeds, evaluated pricing models, and broker quotes for the same instrument must be considered. The price which ultimately gets selected must be tagged with its underlying source as well as documentation regarding how it was chosen. As a result, regulatory demands for a transparent and defensible process will be met.

Once on top of compliance, there are business benefits to be gained. By adopting this approach to independent pricing and valuation, an asset manager can avoid operational and reputational costs associated with miscalculations. Therefore, customers and prospects will have increased confidence in their ability to manage risk. As a result, an asset manager’s reputation is enhanced, and new revenue opportunities will start to emerge.

Crucially, in a multi-asset market and a climate of reducing costs, price validation approaches must be accessible, easy-to-implement and able to handle any asset type, including exotic instruments. Asset managers have already shown that they are increasingly drawn to managed services offering quick deployment, there is a segment of the market that still prefers the traditional in house deployment, price validation should be no exception. It is entirely possible to deliver the benefits of consistent, defensible and transparent pricing with minimal impact.

The upshot is that with a quick and reliable route to performing price validation, the advantages far outweigh the challenges involved. Asset managers can be confident that they are reporting defensible prices, resulting in sound fund performance results. Perhaps the most important outcome is more loyal customers and confident investors, leading to positive reputations. And in a volatile and risk-conscious market, that is a precious and sometimes elusive trait.

In the absence of a single source to validate prices against it is paramount that firms can apply multi sourcing and demonstrate consistency across pricing models underpinned with complete transparency and data lineage. This approach delivers greater confidence and better manages pricing risk to satisfy regulators and investors alike.



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Devendra Bhudia, was appointed in 2008. His responsibilities include providing thought leadership for the GoldenSource data management platform. Dev's career spans more than 15 years during which he has gained considerable experience within the data management arena for the financial services sector. Dev has been involved in the architecture development of the GoldenSource 360 EDM platform, and future product roadmaps.

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IFRS & AIFMD - MANAGING FAIR VALUE PRICING & THE TRANSPARENCY PARADIGM

Jayme Fagas, Global Head of Valuations and Transparency Services

The spate of recent and upcoming regulations focused on valuations, pricing transparency and disclosure pose enormous challenges for the global financial services industry. Overall, the focus is on enhancing visibility into how financial markets function, and identifying and measuring systemic and institution-specific risks. For market participants, the key to complying with these changes lies in timely, accurate and transparent pricing and reference data.

MEETING THE DATA CHALLENGES

The post-crisis regulatory reform agenda shares common themes: robust asset and liability valuations, detailed risk assessment and stringent reporting responsibilities, underpinned by a doctrine of transparency.

The quality, integrity and transparency of an institution's pricing and reference data in particular will determine its ability to meet the onerous risk assessment and regulatory reporting requirements being enacted.

This emphasis on transparency focuses on substantiating the underlying methodologies; granular data inputs that go into formulating the prices of different asset types, positions and risk calculations that are reported.

EVEN MORE TRANSPARENCY AND DISCLOSURE

Various regulations including Dodd-Frank, EMIR, UCITS and last but by no means least the AIFMD (The Alternative Investment Fund Managers Directive) – aim to increase transparency and disclosure of exposures to financial markets.

For example, the Form PF rule in the United States calls on registered private fund advisers (hedge funds, private equity funds and liquidity funds) to furnish regulators with regular,



detailed reports covering many areas of their businesses and activities. By enhancing transparency, the rule seeks to help supervisors monitor the buildup of risk in the system. Given the onus put on these disclosures, report inaccuracies or omissions could result in significant reputational, legal and financial damages.

On October 1st 2013, ESMA published guidelines on the reporting obligations for Alternative Investment Fund Managers (AIFMs), together with an opinion setting out supplementary information that should be reported for systemic risk monitoring.

The scope of the AIFMD is wide and, with a few exceptions, covers the management and administration of Alternative Investment Funds (AIFs). Its focus is on regulating the AIFM rather than AIFs.

The AIFMD was established as an EU-wide framework for monitoring and supervising risks posed by AIFMs and the AIFs they manage, and for strengthening the internal market in alternative funds.

The objectives of the AIFMD are:

- To improve supervisory practices among EEA (European Economic Area) competent authorities to support timely and pre-emptive action to limit market instability and the build-up of systemic risk in the European financial system
- To improve customer protection by imposing new depositary standards, enhanced transparency through new investor disclosure rules and mandatory reporting to competent authorities
- To foster efficiency, cross-border competition by deregulating national barriers and creating level playing fields through harmonized rules

Common requirements for the AIFMD and related regulations are crucial in achieving compliance, primarily the need for accurate, verifiable pricing and valuation data that adheres to fair value disclosure provisions. Robust and consistent data inputs serve as the foundations of the reporting process, since it is this data that feeds the downstream calculations regulators use when conducting their risk assessments.

TIGHTER ACCOUNTING STANDARDS

The way in which institutions must measure and disclose the value of their assets and liabilities has been redefined, standardized under the revised accounting rules developed by the US Financial Accounting Standards Board (Topic 820) and International Accounting Standards Board (IFRS 13 Fair Value Measurement).

The accounting standards provide a consistent definition of fair value, require the categorization of assets and liabilities changes make calculations subject to a “Fair Value Hierarchy,” which requires firms to categorize assets into one of three levels, based on the inputs used (“Fair Value Hierarchy”).

“ The aim of IFRS 13 is to introduce a consistent global definition of fair value, along with enhanced disclosures for how fair value is measured.”

IMPACT ON INVESTMENT FUNDS

Under IFRS (International Financial Reporting Standards) 13, investment management organizations, and where applicable their service providers, will be required to measure assets and liabilities using the new, standardized definition of fair value. Fair value is defined 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 (i.e. an exit price). Fund accounting and fund administration functions are likely to be particularly affected by these changes, potentially requiring updates to systems and controls to ensure data is captured, processed and reported in accordance with the new standard.



TOPIC 820 AND IFRS 13 FAIR VALUE HIERARCHY

Entities should maximize use of observable inputs and minimize unobservable inputs when determining the fair value of assets and liabilities.

- **Level 1** – Quoted prices in active markets for identical assets/ liabilities (applicable for most exchange-traded instruments)
- **Level 2** – Inputs that are either directly or indirectly observable for the asset/ liability (other than quoted prices included within Level 1)
- **Level 3** – Fair value derived from unobservable inputs, involving significant investigation and judgment (typically applies to complex and/or illiquid securities)

FINDING THE RIGHT MEASUREMENT

Meeting the fair value requirement is relatively straightforward where entities invest in securities traded on-exchange or in active markets, since an exit price is readily available. The process is more challenging when investing in complex, Over The Counter (OTC) and/or illiquid assets. The institution must then use a transparent valuation technique to establish the transaction price on the measurement date

“IFRS 13 also enhances market participants’ disclosure obligations regarding fair value measurements, requiring entities to outline the valuation techniques and inputs used to arrive at those measurements.”

The best indicator of the fair value of an asset/liability is a quoted price in an active market (Level 1). If no published price in an active market is available, the fund must use a valuation technique to establish the transaction price on measurement date. This valuation technique must use observable inputs wherever possible.

For traditional asset managers that tend to invest in securities traded on-exchange or in active markets where an exit price is readily available, meeting the fair value measurement requirement will be relatively simple.

The process becomes more complex for entities such as hedge funds and private equity funds that invest in complex and/or illiquid assets. Some of these instrument types, such as interest rate swaps, will benefit from well-established valuation models and a preponderance of observable inputs.

Furthermore other assets – for example certain structured products, OTC derivatives, unlisted papers will depend primarily on unobservable inputs, where significant investigation and judgment is involved in reaching a fair value measurement.

APPLYING TRANSPARENT REPORTING

IFRS 13 also enhances market participants’ disclosure obligations regarding fair value measurements, requiring entities to outline the valuation techniques and inputs used to arrive at those measurements. This is particularly relevant in the case of Level 3 unobservable inputs, where disclosures will need to include detailed quantitative and descriptive information in order to provide transparency into the inputs and calculations used in determining a valuation.

For investment funds and fund administrators the added disclosure requirements may necessitate changes or enhancements to their fund reporting systems and processes.



Fund administrators in particular will need to be mindful that they leverage robust and comprehensive pricing data sources, and have sophisticated reporting capabilities, since they have to meet the different reporting responsibilities of the array of clients they serve.

Remaining disparities between the IFRS and US GAAP standards further complicate the processes. Funds and fund administrators, that calculate and report valuations under both standards will need to use high quality data sources and flexible infrastructures that accommodate the relevant pricing methodologies, and so enable the organizations to meet the different accounting requirements.

COMMON REGULATORY REQUIREMENTS

ALTERNATIVE INVESTMENT TRANSPARENCY (FORM PF/AIFMD)	
Purpose	Obligations
Enhance transparency to help regulators monitor systemic risk.	Submit regular reports detailing investment positions and exposures, using accurate and verifiable data.
Data Requirements	
To populate their regulatory reports, and meet the tight filing deadlines, alternative investment firms need ready access to reliable, timely and transparent pricing and valuation data for relevant instruments. Only by using robust and verifiable source data that meets the fair value accounting standards can firms accurately determine their aggregate positions and exposures.	

ACCOUNTING STANDARDS (ASC TOPIC 820, IFRS 13)	
Purpose	Obligations
<ul style="list-style-type: none"> • Harmonize fair value measurement and disclosures • Increase consistency and comparability in fair value measurements, especially in markets where trading activity is low 	<ul style="list-style-type: none"> • Defines fair value on the basis of a bid price (price to sell) • Distinguishes fair values derived from exchange-traded financial instruments from non-observable market inputs, using a Level 1-3 pricing hierarchy
Data Requirements	
To comply with the requirements for each of the three levels set out in the Fair Value Hierarchy, institutions need access to a trusted source of fair value measurements, able to deliver:	
<ul style="list-style-type: none"> • Latest quoted prices from listed markets • Observed, reported prices from trusted market participants • Robust evaluated prices for illiquid and harder-to-value securities, backed by detailed quantitative and descriptive information to provide transparency into the inputs and calculation methodology used 	

“ ... it is ever more important therefore that market participants develop relationships with trusted data partners ... ”



THE VALUE OF TRUSTED PARTNERSHIPS

Non-compliance presents huge reputational, and potentially financial risks for organizations. With the cost and complexity of regulation escalating, it is ever more important therefore that market participants develop relationships with trusted data partners to help them navigate this evolving landscape.

CAPABILITIES TO LOOK FOR IN A DATA PROVIDER

- **Pricing Scope** – An extensive and scalable listed markets and evaluated pricing service that can accurately price the full spectrum of assets, backed by knowledgeable staff and the technological capacity to value new and esoteric instruments as they emerge.
- **Transparency** – Meeting accounting disclosure requirements and other regulatory mandates demands a transparent process and workflow for collecting and reporting data, particularly valuations, in a consistent and auditable manner. This includes disclosure of the methodologies used, and an ability to drill down into the inputs to understand how a securities valuation was calculated.
- **Customer Service** – Having easy access to market experts who can explain how an instrument has been priced will ensure customers have confidence in the prices they use.
- **Responsiveness** – Providing clients with a rapid turnaround time to their pricing requests depends on having a combination of the right people, tools and market data.

- **Reference Data Coverage** – Understanding the attributes and associated risk profile of a firm's securities holdings is a vital part of regulatory-mandated calculations. Given the fragmentation of global markets, and proliferation of instruments and identification codes, a data provider's capabilities need to include support of all reference data standards, including new identifiers (e.g. LEIs and CICIs) and classifications.
- **Global Reach** – Evaluations and reference data support depend on in-depth jurisdictional knowledge of local financial markets. Partnering with a data provider that has a global on-the-ground presence and a wealth of local market expertise is crucial in ensuring user firms can meet regulators' and trading counterparties' demands.

Under IFRS 13 & AIFMD eligible market participants will need a data provider with a range of attributes such as:

Coverage Breadth

A provider with the ability to price the full range of securities in which a fund invests is vital if the investment organization is to avoid relying on a medley of pricing services. This breadth of coverage must be both geographically expansive and encompass the entire Level 1-3 fair value hierarchy. Having access to the full universe of securities pricing information is especially important for fund administrators that need to support the varied reporting obligations of their clients.

The IFRS 13 fair value framework also specifies that each transaction should take place in the asset or liability's principal market, or where no principal market exists in the most advantageous one.



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Input Quality

IFRS 13 shines a spotlight on the inputs used to price all financial instruments, wherever they fall in the fair value hierarchy. Being able to demonstrate adherence to fair value best practices – that the valuations used are accurate and are derived from robust and transparent processes, especially for Level 3 calculations – is essential.

Quality of controls is also important. The IFRS 13 standard will result in more transfer of information from data vendors to clients. Since there is more transfer of information, there needs to be more due diligence around that information. The onus on data providers is to ensure they can provide clients with high quality prices that are calculated in a rigorously controlled SAS 70 compliant environment in order to mitigate operational risk within the service provider's infrastructure.

“ A provider with the ability to price the full range of securities in which a fund invests is vital if the investment organization is to avoid relying on a medley of pricing services.”

Pricing Frequency

Reporting under IFRS 13 will be quarterly, and so data providers need the capacity to value the entire universe of securities on a regular basis.

In addition, Level 3 assets require activity to be reconciled throughout the period, to show Level 3 assets at the beginning of the period, the changes inter-period and the ending balances. End-of-period pricing will be insufficient. Rather, the ability to deliver prices for hard-to-value assets on a daily or more frequent basis will be vital for reporting entities such as hedge funds that need to capture this inter-period activity.



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Defensible Valuations of OTC Derivatives and Structured Product Assets

By **Dr. Greg Cripps**, President, Prism Valuation

What are the important attributes of quality derivative and structured product valuations?

In this article we discuss some key terms and concepts in the valuation of OTC derivatives and structured products and discuss the various attributes which render valuations defensible.

We begin with some definitions of “valuation”:

1. Common usage (OED):

“An estimation of the worth of something, especially one carried out by a professional valuer: it is wise to obtain an independent valuation”

2. Accounting (IFRS13, SFAS 157(ASC 820-10):

“Fair value is 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”

Valuation, or the calculation of a fair value, is one of the basic components of financial accounting and risk management. It is implicit in successful asset management that any assets or liabilities held need reliable valuations which reflect an estimate of the likely trade price if one were to transfer the asset or liability in an orderly fashion. Therefore fully transparent and independent valuation is market best practice.

Reliable and transparent valuations are sometimes easy to obtain but more often there is some difficulty involved in producing regular valuations that are both independent and defensible. By a defensible valuation, we mean a valuation which:





- Uses high quality, timely and independent underlying market data,
- Uses industry standard modeling techniques,
- Uses a proper and robust model calibration process,
- Ensures calculations are fully converged,
- Is totally transparent,
- Is supported by a responsive and informative valuation challenge framework.

In short, a defensible valuation is one which will meet or exceed requirements for quality and transparency set by auditors, regulators, risk management departments and clients.

VALUATION APPROACHES

In some situations, valuations are performed intra-day but typically for buy-side firms they are reported at the end of the day (EOD) or end-of month (EOM) for more complex deals. Secondary market prices, often referred to as “Mark-to-Market” prices, by which we mean actual timely traded prices for some instrument as reported by a recognized exchange, trading venue or clearing house are naturally the best data to mark any held positions. The big issue here is that, particularly in the derivatives and structured products world, the instruments for which there are frequent and reliable secondary market prices is a small subset of the universe of instruments, and hence “Mark-to-Model” valuations must often be relied on as the best timely estimate of value.

As an aside, thinking more deeply about any definition of valuation, it is reasonable to say that all financial assets are in reality always marked in some type of model framework where the model reflects the mean price where a trade between two parties will occur. Even valuations for positions that trade on an exchange or trade generally in recognized secondary market venues could still be reasonably thought of as being derived in a modeling framework. In particular, such real world elements as timing, volume and liquidity are generally not considered when marking such positions at for example EOD published market prices.

This is certainly not to cast aspersions on such valuations, but simply to say that in all cases it is important to understand the assumptions that underpin the valuations and that there is really no such thing as “mark-to-market” pricing for held positions - only mark-to-model where there are assumptions applied and varying degrees of complexity and defensibility of the model.

When underlying data is patchy, intermittent or non-existent, or when the pay off structure is complex, possibly including dependence on correlation and/or unobservable abstract model parameters (e.g. mean reversion), the valuation framework has to be more sophisticated in order to provide a set of logical arguments that lead to a defensible valuation. Depending on the liquidity of the underlying instruments, the nature of the pay-off structure, credit issues and so on, the framework can be complex and the set of logical arguments to defend the valuation methodology lengthy.

In the past, many institutions relied solely on counterparty mark for their OTC derivatives and on structured product broker dealers for their structured product valuations. There is, however, a significant hazard inherent in this approach, since the provider of the valuations has an obvious interest in them. Therefore current conventional wisdom is that it is important to have a fully explainable, transparent valuation and an independent valuation process, housed outside of the front office and not reliant on dealers or other potentially biased sources. In many jurisdictions this is compulsory. These valuations with explicit explanations could be produced in-house or through the use of an independent valuation vendor.

There is a consensus that more and more derivatives will be centrally cleared in future and transparent pricing via the exchanges will be forthcoming for more and more deals. However it is also likely true that many non-vanilla and non-standard deals will remain OTC for the foreseeable future. In addition, derivative exchanges often do not give the granularity of information and timing of valuations required by asset managers and investors to satisfy reporting requirements and best calculate inherent risks.



Hence independent valuation and risk analysis of even exchange traded derivatives will be provided by vendors to holders of cleared derivatives. In this case, the value of the vendor's offering will be largely measured by time of delivery and comprehensiveness of data offering; the core defensibility of such valuations will be determined by comparisons to clearing house data. Variations will be easily tracked by analyzing historical performance. For simple products with liquid underlyings, there should be little or no difference between timely vendor valuations and EOD clearing house prices.

Structured products and complex derivatives will continue to be offered for the foreseeable future by dealers wishing to satisfy their customers' bespoke risk requests. In addition, it is highly likely that the evolution of products offered to customers will outpace the adoption of these deals into central clearing. However, regulations including Dodd-Frank and EMIR will push these OTC deals to be centrally reported and trade terms and conditions (T&Cs), valuations and related data (risk analysis, credit exposures, initial margins etc.) will need to be sent to governing authorities. This will naturally increase the scrutiny of valuations in future and compliance will force all agents to better understand valuation issues. Defensible valuations will make this process easier allowing for continued investment choices in the world of increased regulation.

It is also worth reiterating that all risk analysis begins with a reliable, accurate and defensible valuation. A valuation is an essential building block for all subsequent calculations of key risk parameters (market sensitivities, CVA/DVA/FVA, PFE, and VaR) of which many are or will be eventually included in regulatory reporting and are essential for providing the measures to help answer the following pertinent risk questions:

- **Attribution** – can a change in valuation be predicted by all the relevant sensitivities (hedge instruments) and market factor movements? What is the magnitude and reason for any deviance from this prediction?
- **Credit Exposure** – What is the credit exposure to each side of a trade?
- **Exposure Limits Monitoring** – Are any sensitivity limits or other risk limits being breached?
- **Margin** – What is the Initial and Variational Margin?
- **Investment Performance** – What is the performance of an investment relative to an index or other investment?

Compliance to the new and evolving regulations are part of the fabric of investment management, having transparency and scrutiny of the regular valuation process is critical to good risk management and is also a vital part of ensuring that the optimal return is achieved relative to the risks taken for any investment portfolio.

STRUCTURE OF A VALUATION FRAMEWORK

Most OTC derivative (unique to two counterparties) and structured product deals (most often private placements) must be valued in a "bottom-up" valuation framework approach where each deal is modeled individually referencing original deal documentation (prospectus or deal confirm) and synthesizes: a mathematical model, underlying market data, a calibration strategy and adds any other necessary adjustments (for example, credit, funding, counterparty relationships,...).

In more detail, the bottom-up approach consists of the following steps to yield a logically consistent valuation method: a rigorous mathematical modeling and computational framework combined with model targeted calibration strategies constructed using the maximum of the available liquid underlying data which effectively covers all of the inherent risks in the deal, while also minimizing the use of any un-observable parameters and should also be generally well-behaved (converges and allows for sensitivities to be easily calculated). This contrasts with the grid pricing method, where benchmark deals, either real or constructed, are used as “points on a grid” and deal valuations are obtained by linear interpolation or extrapolation methods from the points on the grid. A grid method is often used for valuing asset backed bonds but is not suitable for complex structured bonds and anything but the most trivial derivative deals.

The bottom-up approach requires both financial modeling expertise, access to the best sources of underlying market data and number-crunching capability. Thus we arrive at the three cornerstones of a successful valuation – People, Data and Models. All of these components are important but it is safe to say that the process to obtain reliable and independent underlying data is often the hardest element to sustain and most often drives the models used and the complexity of the calculations required.

Defensible valuations generated by a bottom-up framework require full transparency on the following elements:

1. Appropriate Model Choice:

What is the most appropriate way to value a given trade? In general there is a tradeoff between model complexity and the ability

of the model to fit underlying market data. Hence in general the simplest model which can capture all of the relevant, liquid underlying risks is to be preferred. The specific choice of model is dependent primarily on what underlyings would be used to hedge the deal, the model distribution (e.g. normal, log-normal, multi-factor, stochastic volatility, etc.) that should capture the pay-off possibilities correctly and the ability to calibrate to the necessary hedge instruments. It may be that dependence on additional parameters such as correlation, generally not directly observable in the market, may be important for pricing the trade; in this case these parameters must be determined in a way which is appropriate and consistent with methodologies used by market participants. This may require the model to have a certain dimensionality and possibly further introduces other non-directly observable parameters that need to be calculated. For example, for a deal type that depends on the volatility of volatility such as a cliquet equity option will need to be calibrated to a stochastic volatility model (e.g. Heston) in order to capture the significant risk this deal has to the variance of volatility. Even though some of the stochastic volatility parameters may not be directly observable, it is important to estimate these as best as possible and capture resulting volatility surface evolution to which this deal pay off is sensitive. Finally, it is crucial that the chosen model be implemented in an appropriate and stable fashion (analytic formulae where possible, fully converged grid or Monte Carlo methods where this is not possible).

2. Unbiased Underlyer Data

It is important to determine the best data to use to calibrate the selected model and capture this data in a reliable fashion.



The data must be independent, unbiased and timely. Market data processing such as bootstrapping, interpolation and extrapolation, should be performed in a consistent and market standard manner. Linear methods should be preferred unless there is compelling reason to use higher order methods. Other model inputs, correlations, mean reversions, and so on, are created using accepted methodologies, generally inferred from observable market data if possible and calculated using historical analysis if no data is available. (Special attention is required when calculating correlations for deals that may have very high sensitivity, for example, some basket options.) When valuations for particular deal types can be intermittently benchmarked against observed market levels, it may be possible to back out some non-directly observable parameters as adjustments to statistical calculations using historical data; this is particularly true for correlations. Any observed market prices for complex and/or illiquid deals can be analyzed to provide tests on model choice and/or un-observable model variables. The data is preferably obtained via an inter-dealer broker where any bias adjustments are negligible. However, any data is useful for benching as long as any bid/offer or credit/funding biases can be estimated and explained. Often there is no or only intermittent liquidity and therefore no price transparency for underlyings. With care though, proxy methods can yield useful data to provide reasonable ways to value a deal dependent on such underliers. Replicating the actions of a good trader, using liquid underlyings as a starting estimate of the value for any deal type that has not traded recently is a reasonable way to value illiquid trades. Complexities include choosing a good proxy and determining correlations. There may be more than one way to provide a reasonable

proxy for an underlying and hence valid differences of approach.

3. Adjustments

Additional adjustments may need to be considered to account for aspects not explicitly covered by a model or market data. The relationship between derivative counterparties can play a role in each party's valuation, particularly concerning mutual credit and funding exposures and also any possible relationship value between two counterparties.

VALUATION CHALLENGES

An important component of defensible valuations is the valuation challenge process. Where valuation differences are observed they can generally be attributed to one or more of the following factors:

1. Trade Terms and Conditions (T&Cs): It is obvious that one must have a full set of correct terms and conditions details in order to value a trade. However, valuation differences are often due to differences in trade setup. There is impetus here for more standardization and this will be welcomed by all parties, however it is likely that deal-type evolution will work faster than the standardization of deal terms and that effort will always be expended in ensuring accurate trade capture. Valuation vendors (Prism, Markit, Super Derivatives, and so on) are offering more and more tools to resolve this issue and there are specialist product providers that can offer matching engines to resolve T&Cs between parties (e.g. Coretexa, Trioptima).



2. Valuation Timing: A frequent cause of differences between valuations is the timing. This issue is easily resolved when underlying market data is provided with valuations as a point of reference.

3. Model differences: These are not very often seen as there is general consensus of valuation models suitable to use for most deal-types. They do on occasion occur though, particularly for more complex trades with dependence on more subjective factors such as evolution of volatility surfaces and/or correlations.

4. Data sources: In defending a valuation, it is very important to understand exactly where any challenge value is coming from and what underlying market data is being used. The best sources of data are independent and reliable secondary trading venues such as exchanges. Independent inter-dealer brokers, like ICAP, Tradition, Tullet Prebon and GFI are also excellent sources as the data provided reflects independent, unbiased information regarding trading prices or good two way indications. When using data aggregators as data sources, attention must be paid to where market data points are actually originating from, it isn't always from the people who are delivering the numbers. If there is no independent data potentially biased data is the next best thing as long as it is clear where it is coming from and there is some estimate of any "dealer spreads" inherent in the data; it also useful for deal valuation benchmarking or reality checks. An example of this phenomenon is the issuer of a structured note providing valuations of their paper discounted not on their secondary

market credit curves, where any other agent would likely buy or sell the asset, but at a higher price. The issuer is effectively adding a "relationship" adjustment to their valuation, this assumes that their customer will likely buy future new issues where traditionally there are significant premiums paid. It is important for any asset holder to understand these costs and hence the value of the note were they to sell in the secondary market and not back to the issuer.

5. Theory of Relativity for Valuations: Each party to a derivative has their own relative position in mind when valuing it, where future cashflows would be potentially funded and how any exchanged collateral might be treated. Therefore derivatives valuations will not generally be the same for both counterparties. There can be significant differences between two counterparties depending on the makeup of their mutual portfolio: their internal funding rates, their mutual CSA and netting agreement and their collateral management process.

Specific questions that should be answerable in a defensible valuation:

- How reliable are the Terms & Conditions of each deal. How are changes to deal details monitored?
- What underlying data is used? Where is the underlying data being sourced and how reliable and independent is it? Are there any potential biases in the underlying data?
- If the deal or deal type itself can be intermittently benchmarked, how well does the model perform and how reliable is the benchmark data.

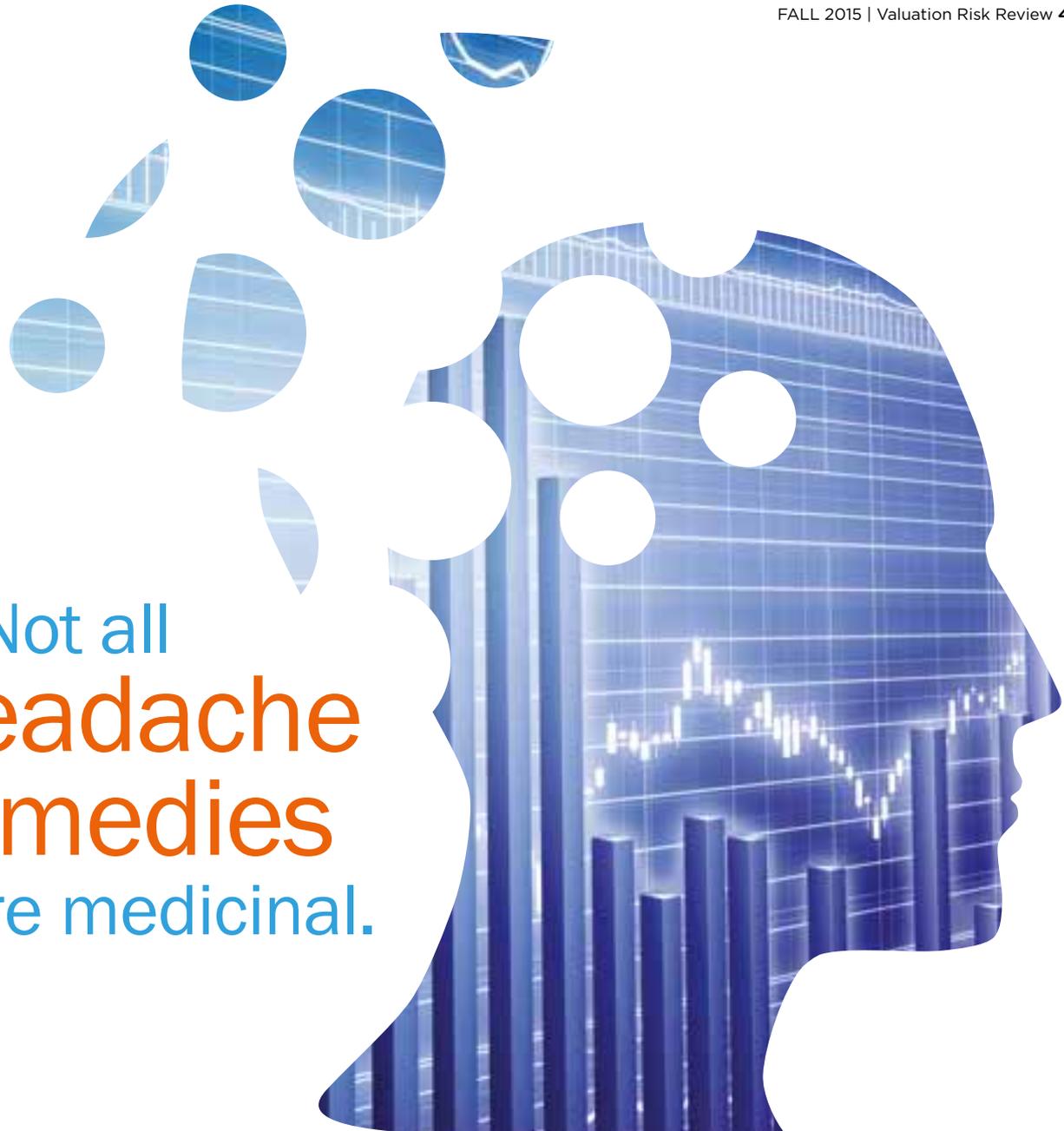


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- What primary risks are involved in a given deal and why was a given model chosen against any other? Is the model capturing all the risks, if so it is the simplest version that can do this? Is this model widely used in the financial industry?
- What is the credit risk and credit risk sensitivity and do counterparty funding levels explain any value variation?
- Is there any relationship value inherent in the deal? Can this explain any seen valuation differences?
- Can the day-over-day value changes be reasonably attributed, i.e. explained with the underlying data changes?

SUMMARY

In summary, the importance of independent valuations in the financial derivative and structured asset space is growing, driven both by evolving best practice and the ever-stricter regulatory environment. As oversight of independent valuations sharpens the importance of the defensibility of the valuations increases. Defensibility is a multi-faceted concept which addresses reliability, accuracy, transparency and support. A purchaser of independent derivative valuations should place great importance on ensuring that their vendors provide defensible valuations.



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are medicinal.

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MODELS & ANALYTICS



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current situation...
ately, it will allow...
pects of development...
eration of positive...
As a result of...
break-even sales level...
costs to transportation...
personnel training...

Mark to Make Believe?

Dealing with Model Risk, Uncertainty and Validation in the Post-Crisis World

In August, Ian Blance, Managing Director of Voltaire Advisors, engaged with a number of senior professionals from leading providers of pricing models and risk analytics to get their views on key issues in this part of the industry.



DERIVITEC®

George Kaye is Founder and CEO of Derivitec. George has over a decade of experience as a quantitative analyst ('quant') in the investment banking industry. Starting at Credit Suisse First Boston's Product Development Group in 1999, George quickly specialised in the field of equity derivatives, building models and infrastructure for the trading desks. In 2006, he left to join the Derivative Analysis Group of Goldman Sachs, where his responsibilities focused on building a methodology for model risk analysis of the firm's equity derivatives positions. In 2010 he returned to the front office, working in the equity derivatives section of the Quantitative Analysis Group of UBS Investment Bank, leaving at the end of 2011 to build his own derivatives software company.

George holds a PhD in theoretical physics from the University of Cambridge, and has published a book on equity derivative model risk, *The Value of Uncertainty: Dealing with Risk in the Equity Derivatives Market* under Imperial College Press.



FiNCAD®

Russell Goyder, PhD is Director of Quantitative Research and Development at FiNCAD. Before joining FiNCAD's quant team in 2006, Dr. Goyder worked as a consultant at The MathWorks, solving a wide range of problems in various industries, particularly in the financial industry. In his current role, Dr. Goyder manages FiNCAD's quant team and oversees the delivery of analytics functionality in FiNCAD's products, from initial research to the deployment of production code. Dr. Goyder holds a PhD in Physics from the University of Cambridge.



NUMERIX

Satyam Kancharla is Chief Strategy Officer and Senior Vice President at Numerix. He is responsible for corporate strategy and currently heads the Client Solutions Group. This group is responsible for Product Management, Financial Engineering and Business Analysis. Prior to this, he has served in various roles in Quantitative Software Development, Financial Engineering and Client Services at Numerix. Before transferring to Numerix in New York City, he was the CTO for Numerix Japan LLC in Tokyo, heading the Pre-Sales and Financial Engineering teams for Asia. Prior to joining Numerix in 2003, Mr. Kancharla also worked with Merrill Lynch and GE Capital in Quantitative Finance and Product Development roles. He holds an MBA degree from New York University's Stern School of Business, an MSc degree in Applied Statistics and Informatics from Indian Institute of Technology, Bombay and a BSc in Mathematics and Computers from the University of Mumbai.

THE RESULTS OF THIS EXTENSIVE AND DETAILED Q&A SESSION ARE RECORDED HERE.

Ian Blance (IB) – Pricing models and analytics are widely used in the valuation industry, but very few people have the quantitative skills to fully understand how they work. How does a model provider deal with the issue of being described as a ‘black box’?

George Kaye (GK) – The key here is transparency. Any price that the model comes up with should have as much supporting analytics, data and documentation as possible attached to it. So, for example, if you’re pricing a variance swap, you should be able to see the vol slice which went into the replication valuation, you should be able to see the strikes that were used in the replicating portfolio, you should be able to see any dividends which were included, what forward and discount factors were used, and why, through drill down into the supporting market data. And the whole thing should come with a full technical description, listing all the assumptions and modeling techniques. Like this, a customer can, in principle, replicate your numbers independently, and discuss any discrepancies with reference to clearly written documentation.

Russell Goyder (RG) – To avoid being a “black box”, model providers should concentrate on a couple of key areas. The first is their technology packaging approach. It’s important to design offerings that allow users access and visibility into the technology so they can easily make modifications and determine what is going on at any given time. Consider this analogy. The difference between a black box vendor’s product and a sophisticated model provider’s product can be likened to the difference between an off-the-shelf toy car versus a lego kit that allows you to build your own toy car. If you attempt to open up the ready-made toy car in order to, say, fix a wheel or replace a screw, you may find odd-sized parts that are not easy to replace, or that the car is simply irreparable once disassembled.

In contrast, the lego car can be easily deconstructed, altered or enhanced as you see fit. The “lego approach” is what FINCAD has designed its F3 platform around. We have identified the fundamental building blocks that are used over and over again when calculating the price and risk of derivatives portfolios. When a user needs to solve any pricing problem, they can do so using these fundamental components. Furthermore, they always have the option to drill down and view the details of what’s going in each of the “lego pieces.”

Sometimes there can be too much transparency, so it’s important not to force a highly granular experience onto a user of models. This is achieved by wrapping up the low level details into easily consumable packages. If easily consumable packages is all you have, however, then you can’t drill down into the details should the need arise.

Thorough and accurate documentation is a key component of avoiding a black box offering. We are seeing “analytics consolidation” as the industry moves toward a more commoditized view of models, adopting established, industry standard practices. This works in favor of transparency, as what would otherwise be vendor-specific documentation is now widespread in the quantitative finance literature.

Satyam Kancharla (SK) – As regulatory pressure continues to increase, institutions have elevated the importance of managing their model risk. Regulatory focus has largely shifted to the “how”— regulators want to know how the models work and how to approach these models.

As with any category of risk, model risk management involves measuring and managing the risk. Addressing Model Risk involves assessing and creating transparency about how a model behaves. This is an issue the industry faces for both internal and vendor supplied models.

At Numerix, we have created a number of automated tests that we use for our model risk assessment internally and also provide to our clients. These tests measure various aspects of model risk – convergence, hedge effectiveness, calibration, PDE consistency, etc. A model risk report that summarizes these tests and creates an overall score helps to create complete transparency to how well the model functions – or does not.

IB – What are the main challenges in providing a consistent risk/valuation framework across different asset classes?

RG – One challenge to providing a consistent risk/valuation framework across different asset classes is that it is very easy for quants to either willingly or accidentally conflate pricing models with trades. Let me illustrate with an example. Let’s say you have a swaps desk responsible for building interest rate curves and managing the swaps book. The quants at this desk have a very

specific area of focus and, are not, for example, too concerned with volatility modeling.

Then elsewhere in your firm, you may have an interest rate volatility desk, responsible for trading caps, swaptions and other interest rate products such as Bermudian swaptions. Both desks need swap analytics, but will they be consistent? Recently we have seen that the choice of clearing venue can have a material impact on swap PnL – something the swaps desk will pay careful attention to. What about the swap analytics in the Bermudian pricer? All too often, the same trade (here, the underlying swap) has a different treatment because of the modeling context.

The solution to achieving consistency starts with being very disciplined about separating trade specification from modeling – separating what is being valued, from how it is being valued. To do this, you need a model independent representation of terms and conditions. This philosophy is at the heart of FINCAD'S analytics library.

A second important element to achieving uniformity is to utilize a lego brick approach to pricing as I described in question one. Imagine you have a swap pricing lego brick that can be used directly as a swaps pricer in a swaps desk, and that you could also plug into your Bermudian pricing analytics. This approach will guarantee swaps will have the same treatment regardless of what desk they are being priced.

A big barrier here, however, is that consistency in analytics is very machine-like, and we as humans, are not. For this reason, the uniformity of the lego approach is very useful in establishing consistency and continuity. In our F3 platform, we take it one step further by not only providing firms with these building blocks, but also the robust infrastructure that puts blocks together appropriately for users, thereby guaranteeing consistency. All users have to tell our system what is being priced, and how, then the appropriate pricers will be assembled for them.

Another challenge to providing a consistent valuation and risk framework across different asset classes relates to credit value adjustments (CVA). CVA must be calculated at the firm level. For historical reasons, CVA is often treated as a VaR-like calculation – a simulation over market scenarios, instead of the hybrid risk-neutral valuation that it is. Owing to the challenges of constructing hybrid models, dedicated CVA models are common in the literature to capture phenomena such as Wrong Way Risk.

This leads to a need to reconcile CVA models with pricing models, which comes with its own

challenges and is a source of inconsistency. The solution to this problem is to use a hybrid framework that is truly multi-asset class, able to combine any marginal distributions into the correct joint distribution, and capable of accommodating correlations between observables from different asset classes. Then CVA is just a hybrid pricing problem and phenomena such as Wrong Way Risk are a simple consequence credit volatility and correlation with observables in the portfolio.

We have taken this approach to CVA since 2010 – the same approach taken by Danske Bank, who won Risk Magazine's 2014 "In-house System of the Year" award.

SK - We have continued to hear the same challenge from our clients, that they not only require the flexibility and transparency to define instruments, curves and risk scenarios, but also need the ability to scale performance in real-time. Flexibility is typically the Achilles heel to accelerated performance, when you think about the huge quantities of data that need to be generated for revaluations and risk on a real-time basis.

We took on this challenge with the Numerix CrossAsset Server; we've been able to preserve the flexibility that front office quants require while meeting the performance benchmarks for traders and risk management operations. Our single platform approach for holistic risk management enables Numerix to assess both pricing and risk consistently – with complete flexibility and unprecedented levels of transparency.

GK – First and foremost, consistent market data. It's sadly not uncommon for large institutions to have multiple versions of the same rate curve marked in different ways by different traders in different locations, with models using the curves marked in that location only. Like this, many firms run the risk, in theory, of so called 'internal arbitrage'. The best firms, on the sell side at least, have invested considerable resources in having a globally agreed marking methodology, with a common pricing platform accessing that data. This last point is also crucial. You need everyone to price off the same models, using the same technology. This is well illustrated by our own platform at Derivitec. You have one source of market data, marked consistently, accessed through one platform, through the web. Everyone sees the same price and risk, no matter who, no matter where. This immediately facilitates aggregation, not only

over multiple asset classes, but also multiple institutions, e.g. for a fund of fund manager, or a prime broker managing multiple funds.

IB - *There have been a number of new requirements from valuation and risk models in the past few years (such as the various value adjustments and OIS). What, in your view, are the most important?*

SK - Since the global financial crisis, OIS and CSA Discounting has emerged as a market standard for valuing swaps and interest rate derivatives, but the speed and level of adoption varies widely among buy- and sell-side firms due to some of the complex challenges of putting an effective framework into place. At Numerix we regularly speak with market participants to address their concerns and questions about OIS discounting and curve construction.

Regarding XVA pricing adjustments, they not provides better control over all components of derivatives risk management. It not only gives users the ability to derive insight into which trades are better economically for their business, but helps to more effectively manage the capital set aside for derivatives trading operations under new regulations. All of these elements must be considered for transparent decision making, strategic planning and the allocation of resources.

RG - In the last few years, there has been an explosion in complexity of curve building prompted by clearing counter party risk collateral agreements. Now it is quite common for quants to be building tens of curves in just a small number of currencies.

Over the past few years, our industry has expended a huge amount of effort on updating curve builders and accommodating OIS curve building and discounting. But, it doesn't need to be this way. All curve builds and calibrations have a common structure. If you can identify that structure and work with key reusable components (i.e., the lego bricks I talked about in prior questions), then you can more readily cope with the complexity.

Often a lot of the work of code building is related to speed, or calculations that let you construct a risk ladder in real-time. The conventional bump and grind method for obtaining such sensitivities is in widespread use today. Unfortunately, this approach presents the need for curves to be built and then rebuilt, and thus places a focus on highly bespoke curve

building code. A better approach here is to use Algorithmic Differentiation (AD) which can calculate a full risk ladder astonishingly quickly, without bumping. In FINCAD's implementation of AD, called UAD, your risk ladder is always available regardless of how complex your curve structure is.

Another key requirement that is making quite an impact on the derivatives marketplace is CVA, which is best regarded as a big hybrid problem. I feel that many in the industry view hybrid problems as complicated unnecessarily. There is a huge body of literature that goes through the mathematics that you need to construct a proper hybrid model in various special cases. In fact, it is possible to automate that math and calculate numerically the corrections that you need to apply to each marginal distribution in order to obtain a correct and self-consistent joint distribution. We have made this functionality available in our F3 platform.

A last important requirement in the risk and valuation space pertains to clearing and initial margin. This new requirement is now being standardized in the Standard Initial Margin Model (SIMM). The aim of SIMM is to set margin requirements for non-centrally cleared derivatives. What's needed to comply with this initiative is the very risk ladder we talked about above. Using UAD in this context should offer a tremendous advantage for obtaining initial margin calculations.

IB - *There is also an increased focus on model risk. What are the best techniques to analyze and counter this risk?*

GK - Actually I was so enthusiastic about this question that I went and wrote a book on it, but to be honest, when I finished it I found that I'd raised more questions than I originally started out with! The best way to analyze model risk, though it may seem obvious, is to build multiple models to price the same trade. The constraints on an industrial trading system are very severe. All market data needs to be processed quickly and cleanly, and calibrated efficiently and stably. Shocks to the underlying data need to result in easily comprehensible risk, without weird numerical instabilities coming from poor calibration of unintuitive parameters. Extrapolation needs to be performed according to easily understandable parameters, with interpolation adhering to strict no arbitrage constraints. In practice, this limits the number of models in daily use at investment banks to a handful. Many of these

completely miss effects which we can clearly see, e.g. volatility of volatility, correlation skew, dividend volatility, simply because the operational cost of implementing them, and managing the uncertainty around their marking, would be prohibitive. Put simply, your risk just wouldn't be done by the next trading day. That shouldn't stop the middle office from building these enhanced models and coming up with measures as to how uncertain the price and risk of the trades on the books is given the uncertainty in the 'illiquid' model parameters, i.e. parameters for which there is little or no market discovery. Just how you counter that uncertainty is itself still a hotly debated area. Model risk is not something that can be 'managed' like market risk, i.e. you can't hedge it, almost by definition. You can offset it, or more commonly you can reserve P&L against it, but really prevention is better than the cure here. Model risk should be continuously analyzed, challenged and calculated, if only to prevent the firm building up positions where a mass change in market modeling practice on those trades ends up hurting it materially.

RG - One important practice for countering model risk is to keep in mind that models are just models. That is, understand the assumptions on which they are based and don't give them more credence than they deserve. The truth is that you need to have the right combination of models, practices and expertise. An important part of this is ensuring collaboration between your quants, risk managers and traders. You also need to employ savvy quants that are not just academics, but truly experienced and effective decision-makers who can understand the both the model and the underlying assumptions of the model.

Another technique to counter model risk is analyzing the effect of replacing a given model prior to changing it. For example, if you have five different model possibilities you are considering, it's valuable to line them up and determine the effectiveness of applying each one. I find that this practice is not done as much as it should be because models are expensive to implement and changing them is often a reengineering exercise that requires quants to write code.

My view is that changing models using a lot of analytics systems today is unnecessarily complicated. There should be no reason for reengineering or code writing. Really the process should be akin to switching out hard drives in modern servers. When hot swapping hard drives, you don't even have to power down

a machine. You simply remove the old hard drive and swap in another.

FINCAD's F3 platform sets the standard in its ability to line up models of interest for evaluation. Using the platform, there is no need for quants to expend time writing code, as model changes are an easy configuration change.

SK - When it comes to model risk the best techniques to analyze and counter this risk are:

1. Knowing and understanding the assumptions behind the models
2. Understanding the challenges with the data quality that go into the models
3. Analyzing the results, and interpreting them accurately

IB - *Given a range of models available for most asset classes, users also need to validate their chosen model. What are the best options to achieve this?*

RG - The first principle of validating a chosen model is making sure that all the calibration instruments are repriced. This should not only be done in isolation, but by using the same setup used for actual pricing. FINCAD's F3 guarantees complete consistency between (i) pricing performed in calibration, and (ii) pricing performed after calibration, with the calibrated model. F3's lego and pricer-generator structure ensures that the same analytics are used in both (i) and (ii) for all models, trades and valuation methods. UAD gives you an additional calibration check - in addition to just repricing the market, you can make sure each quoted trade is exposed only to itself.

The next step is to test the appropriateness of the model. This can be achieved by comparing model prices to traded instruments of similar nature, obtaining broker quotes, using consensus data—or a combination of any or all of these.

Other important aspects of validating a chosen model are to verify the predictive power of the model and the stability of internal model parameters (such as stochastic volatility parameters over time). This goes hand-in-hand with measuring the dynamic hedge effectiveness of the model and the capability of the PnL explanation. It's worth noting that F3's Consistent Market Model capability facilitates all of this nicely. Each Model contains a snapshot of market data, enabling you to store and

work with a historical time series, and examine valuations, model parameter values and PnL explanation/attribution. For PnL, UAD is helpful in dramatically speeding up the calculation of the greeks/sensitivities needed to form the predictions inherent in the analysis.

Best practice when you have a full range of models you are validating is to estimate the range of model uncertainty inherent in the respective financial instrument under consideration. The cost of attaining this best practice is directly related to the cost of changing models. F3's structure allows models to be "hot-swapped" in the same way that hard drives are replaced in modern servers without powering them down.

SK - From a Numerix perspective, we've developed an extensive testing regime that certifies the mathematical and financial correctness of the models as well as their performance and stability. What is truly ground breaking is the creation of an automated solution, Numerix Model Validation Studio, a software offering which eliminates the need for an error prone and slow manual process. With the solution, model risk groups have the ability to test model performance on a daily basis against real markets, with greater accuracy utilizing thousands of scenarios.

GK - You need to establish a test framework, in as granular a way as possible. Going back to my variance swap example, how would you validate the model? Well first, is the expected variance zero when the implied volatility is zero? Is the expected variance the implied variance when the volatility surface is flat? When you introduce a cap to the realised variance, is the price always less than the value without the cap, with that difference smoothly falling to zero as the cap is taken to infinity. When you introduce dividends, is the correction consistent with a Monte Carlo simulation? In a dividend corrected swap, is the value zero when the implied volatility is zero? And so on. You should ask as many questions around the model as you can, and try to test the model without reference to the underlying pricing technique. We provide full documentation on all such tests, commonly referred to as unit tests, and are always happy to introduce further tests as suggested by our users.

IB - Regulation is a driver in most areas of valuation and risk. What is the main regulatory drivers for models and analytics?

SK - Basel 3, Dodd-Frank, Solvency II, and of course, the Supervisory Guidance on Model Risk Management (OCC Bulletin 2011-12) all continue to force a major shift in model risk governance best practices as well as pricing & risk analytics. Basel Committee on Banking Supervision FRTB, BCBS 239 Risk Data Aggregation and Risk Reporting.

Also, Basel Committee and International Organization of Securities Commissions' (IOSCO) revision to the original framework for margin requirements for non-centrally cleared derivatives has had a major impact on risk management. Updating risk infrastructure to handle stress tests as part of CCAR.

RG - A key area of focus for regulator is ensuring that the capital requirements set out for financial institutions are not threatened by models and analytics, and them being used inappropriately. This tendency is reflected in recent efforts to strengthen capital requirements such as Article 105(14) of Regulation (EU) No 575/2013 or "Prudent valuation." This directive not only requires financial institutions to choose an appropriate model, but also to take reserve against model uncertainty up to a confidence level of 90%. The impact is thus most noticeable for structured products which bear an inherent model risk.

But compliance aside, implementing effective risk policies that are designed to continuously manage capital are required for the long-term success of a bank. To meet tightened capital requirements, firms require accurate and reliable valuation of financial instruments. FINCAD's F3 is designed to provide users with the flexibility to accurately value virtually any financial instrument or portfolio of instruments. Using a best-of-breed third-party solution such as F3 enables firms to meet compliance requirements quickly and accurately without needing to expend resources on in-house software builds.

IB - What does the future hold for models and analytics providers? What should we be looking out for in the next 3-5 years?

GK -Pricing and risk are becoming increasingly commoditised. Over the next 3-5 years, and I would actually advocate a shorter time scale, we should find that the pressure from regulators on firms to consistently report and manage risk results in a rise of usage of third party risk platforms, with a corresponding downward pressure on the cost of those platforms. The days of the \$50,000 price floor on a piece of risk management kit are over. Local installations will be all but replaced by SaaS solutions. And the days when smaller firms could get away without a risk system will never be seen again. Risk management is now a global problem, and those providers who are able to address that problem in as cost effective and seamless a way as possible will be the ones who survive, and survive well.

RG - The future for models and analytic providers will follow a strong path of standardization. In the current landscape, it is no longer necessary to provide cutting edge analytics in order to distinguish one's self from market competitors. What is required is the ability to offer a range of best-in-practice models as this is much easier to justify and explain to respective auditors and accountants. FINCAD has adopted this approach from the very beginning.

SK - I believe that an important theme in the coming years is integrating insights from advanced analytics to gain better operational efficiency across the enterprise. This requires modeling consistency across the enterprise, a scalable architecture and making advanced analytics more "accessible" to key decision makers at the desk or in the C-suite.

Institutions require real-time results for fast trading and risk decision-making. The need for greater operational efficiency, and the integration of risk and capital analytics into trading decisions is also critical. We see the market adopting a more integrated and holistic approach for managing risk, assessing trade profitability and allocating capital to their businesses. This combines real-time performance and a robust IT infrastructure for risk and pre-trade pricing. Through the instant analysis of large volumes of complex and dynamic data, financial and insurance institutions will be able to achieve a timely, more accurate view of risk enterprise-wide.

While real-time and predictive analytics are well defined, agile means consistent, flexible, scalable and responsive.

Many people in the front or middle offices of financial institutions view cloud computing as something their IT department deals with and not a technology they could directly use or benefit from. The status quo has changed, and in 2015 we will continue to see cloud technology for risk management being leveraged to dramatically reduce calculation times and provide faster results back to the user to facilitate faster decision-making.

With regulators and internal risk teams now requiring real-time results and enterprise-level risk assessment, today's financial institutions have found themselves without the consistent scenarios and analytical underpinning for business-critical activities - such as stress testing, limit setting, projecting capital in to the future and observing how potential exposures will behave over time.

There is a growing need for scenarios that are consistent across the traded markets as well as the real world. Being able to use these consistent scenarios across the enterprise and do projections based on those scenarios will help institutions to calculate capital and reserves, allocate capital across the firm and enhance profitability.

It's clear the regulatory mandate going forward is to conduct stress testing every quarter, and doing this manually is no longer an option. Institutions need to employ stress testing and scenario analysis as part of a holistic risk management framework and banks that are able to automate stress tests will be better equip to identify risks in their market.



Empowered Decision-making: Integrating 'Real-time' Risk into Pre-Trade Analysis

Satyam Kancharla, Chief Strategy Officer &
Senior Vice President, Client Solutions Group, Numerix LLC

Financial institutions continue to face growing pressures on their current business models as regulations in the derivatives market continue to be rolled out and implemented. With evolving regulations considered key drivers behind the new era of 'real-time' risk management, integrating pre-trade analysis into the front office and trading desk has taken on ever-increasing importance. As a result of the changing regulatory landscape, the focus on front-to-back operational efficiency has resulted in the need for an integration of insights from risk management into trading decisions.

REAL-TIME RISK PAVES THE WAY FOR RISK-INFORMED DECISION-MAKING

As for the paradigm of 'real-time' risk that everyone is envisioning these days—what exactly does it mean, and what are the components that comprise it? While we've come to see that 'real-time' means different things to different market participants, overall today's financial institutions require real-time results for fast trading decisions and risk-informed decision-making. Despite a relatively open definition of 'real time' within the industry, market participants realize that systems need to be scalable and flexible enough to meet different demands—as well as being able to perform effectively across multi-asset trading environments.

The integration of risk and capital analytics into trading decisions is now more critical than ever. Driven by regulatory and profitability demands, the increasing need for more information and wider-reaching risk analytics is creating the necessity for more compute power—which is paving the way for greater operational efficiency. From liquidity management to the growing scope of stress testing requirements and overlapping responsibilities across the enterprise, market practitioners are increasingly asking themselves: What now? What's next?



Moreover, as institutions continue to embark on implementing the necessary changes related to Basel III, there is the distant hum of what many market participants anticipate to be the genesis of ‘Basel IV’ in the background. From a market risk perspective, all eyes are on the draft Fundamental Review of the Trading Book: A Revised Market Risk Framework (FRTB) guidelines which could bring significant changes. Overall, we believe one of the key issues and biggest challenges related to FRTB will be the focus on expected shortfall, which may result in the need for additional scenarios and methodological changes in order to produce stable capital measures. Another key challenge is likely going to be related to measuring liquidity risk, with more complex measurement horizons. In addition, the need for comparable capital across the Internal Model Approach and Standardized Approach could result in significant changes to the Standardized Approach.

To adapt to all of these shifting regulations and requirements, the market is embracing a more integrated and holistic approach for managing risk, along with a shifting focus towards optimizing business lines and trade activity. Looking ahead, we see a flurry of activity surrounding the development of robust enterprise-wide analytic frameworks, along with market participants leveraging technology advancements to serve risk analytics. This framework is combining real-time performance and a robust IT infrastructure for risk and pre-trade pricing. Through the instant analysis of large volumes of complex and dynamic data, financial and insurance institutions will also be able to achieve a timely, more accurate view of risk enterprise-wide. The end goal is of course ‘risk-informed’ pricing and decisionmaking.

THE CONTINUING EVOLUTION OF THE XVA VALUATION FRAMEWORK

Understanding and managing trade profitability with a complete understanding of the costs associated with the trade lifecycle is also a critical need. Banks are competing more fiercely than ever for derivatives business, but now face a litany of other costs associated with trading derivatives. In addition to calculating the fair value, banks must now account for a wide-range of XVAs to truly capture the costs of conducting derivatives business.

As the XVA valuation framework continues to evolve, today’s derivative practitioners continue to face a new slew of complicated computational and other challenges as they work hard to achieve their end goal—profitability. With ever-increasing regulations being implemented and rolled-out, what should we be looking at when it comes down to best practices in dealing with real-time risk and the growing list of XVA pricing adjustments?



EVA: A BRIEF INTRODUCTION

With the smorgasbord of costs and adjustments clearly impacting the bottom line, introducing the concept of Economic Value Added (EVA)—a global profitability measure—into the derivatives lexicon has enabled practitioners to see the bigger picture. A Trade EVA Framework, as shown in the example that follows, enables us to quantify all of the costs related to a particular trade and to tie all of these costs back to the client margin and thus, net profitability of the trade.

Trade EVA and the Development of a Trade Profitability Framework:



The Trade Profitability Framework Brings the XVAs into Trading Decisions: A trade that is profitable at first glance can turn out to be a loss-making trade when all costs are incorporated.



The Trade Profitability Framework enables us to attribute portfolio-level risk, margin and capital analytics back to the trade. In this example above, we see how a trade with a high customer margin (top bar) can become a net negative EVA (bottom bar) trade due to various costs attributed to this trade. For this trade, we see that FVA and Cost of Regulatory Capital are quite large and eat into the client margin in a significant way.

This type of breakdown obviously enables us to also ask and answer additional questions for making more effective pre-trade decisions. For example, one could ask “How can we structure this trade to create a positive EVA outcome?” which may lead to different trade terms, CSA terms, break clauses or other adjustments to the position.

EVA AND THE XVA MEASURES

Next, we will drill-down deeper into the EVA framework and define some of the more common trade adjustments, such as CVA, DVA, FVA and KVA. Essentially, we will look at the overall client margin, and then deduct all of the other costs as charges against that margin. As we move through a definition of these adjustments, it is important to note the non-linear interdependencies between these measures and to compute them within the same framework. This is important in order to ensure we make consistent modeling assumptions with respect to risk factors, including correlations. Also, it is important to jointly calculate these measures in order to avoid double-counting effects due to overlap between CVA, DVA, and FVA.

In the following section, we will take a closer look into some of the individual components of the Trade Profitability Framework diagram.

1) Credit Valuation Adjustment (CVA)*

Credit Valuation Adjustment is defined as an adjustment to a derivative price based on the counterparty default risk:

EPE = Expected positive Exposure
(simulation-based)

PD = Probability of counterparty default

LGD = Loss given default = (1 - Recovery rate)

*A. Antonov, S. Issakov, and S. Mechkov, “Algorithmic Exposure and CVA for Exotic Derivatives” (November 2011). Available at SSRN: <http://ssrn.com/abstract=1960773>

2) Debit Valuation Adjustment (DVA)

Debit Valuation Adjustment is defined as an adjustment to a derivative price based on the institution’s own default risk.

Conceptually, it is the same as CVA, but takes its own Credit into account.

Important Note: This cannot be added naively to CVA, since there is a joint default or “First to Default” effect, which requires joint calculation of the additive DVA.

3) Funding Valuation Adjustment (FVA)

This Valuation Adjustment is due to the Funding implications of a trade that is not under a perfect Credit Support Annex (CSA).

$FVA = FVA \text{ receivables} + FVA \text{ payables} = FCA + FBA$

Funding Cost Adjustment:

$FCA = (\text{uncollateralized derivatives receivables}) * (\text{duration}) * (\text{self funding borrowing spread over Libor})$

Funding Benefit Adjustment:

$FBA = (\text{uncollateralized derivatives payables}) * (\text{duration}) * (\text{self funding lending spread over Libor})$

Note that the above two categories may be dynamic. The same trade that has positive cashflows (i.e. it belongs to receivables) one year, may become a trade with negative cashflows (i.e. belonging to payables) next



year. Also, note that FBA has common underlying factors with DVA and, therefore adding the two together, will double count.

4) Capital Valuation Adjustment (KVA) - {aka Cost of Regulatory Capital (CoRC)}

Valuation Adjustment for Regulatory Capital is based on the impact of a trade on Risk Weighted Assets (RWA). Since the total RWA is a combination of Counterparty Credit Risk charge, CVA Capital Charge, Market Risk Charge, and Operational Risk Charge, we have:

RWA Total = RWA CCR + RWA CVA + RWA Market + RWA Ops

Valuation Adjustment $\sim 8\% \times \text{RWA} \times \text{ROE}$

Where C% is the appropriate capital charge percentage that applies to the bank. This can vary by the geographical location and also whether an institution falls under the systemically important category or not.

5) Product Costs

Product costs include the initial and ongoing costs specific and attributable to the transaction. This includes hedging costs and other trade specific costs.

6) Overhead Costs

Overhead costs include the cost components that are not directly attributable to a product (non-recoverable costs). However, these costs are necessary to provide or to create the product or service. For example, Legal, Advertising and Administrative costs contribute to the overhead costs.

7) Cost of Margin: Margin Valuation Adjustment (MVA)

This includes costs specific to centrally cleared transactions, including adjustments for Initial Margin & Variation Margin. As margin will start to apply to bilateral OTC trades as well, this

measure can incorporate the appropriate non-CCP margin costs as well.

MORE ON MVA & KVA: THE NEWCOMERS TO 'THE XVA PARTY'

From DVA to FVA and CVA, just when we thought we had it all figured out, we recently found ourselves in industry discussions regarding the newest valuation adjustments to join the 'XVA party'—MVA (Margin Variation Adjustment) and KVA (Capital Valuation Adjustment.)

MVA

The introduction of the March 2015 Basel Committee and International Organization of Securities Commissions' (IOSCO) revision to the original framework for margin requirements for non-centrally cleared derivatives has the market once again contemplating current practices, while evaluating future preparations and operational processes. Also this March, the Basel Committee and IOSCO agreed to adopt a phase-in arrangement for exchange variations margins. In addition, the revision stated that the beginning of the phase-in period for collecting and posting initial margin on non-centrally cleared trades was moved from December 2015 to September 2016 — with the full phase-in schedule being adjusted to reflect the delay, according to the Bank for International Settlements (BIS) — thereby granting OTC derivative market participants a little more time to prepare.¹

With all of these changes on the imminent horizon, it is no surprise to see market participants fully reacting to the imposition of margin on OTC derivatives, whether initial margin or variation margin—and also introducing the MVA adjustment into the picture.

¹Revisions to implementation of margin requirements for non-centrally cleared derivatives issued by the Basel Committee on Banking Supervision (BCBS) and IOSCO – press release, 18 March 2015, www.bis.org/press/p150318a.htm



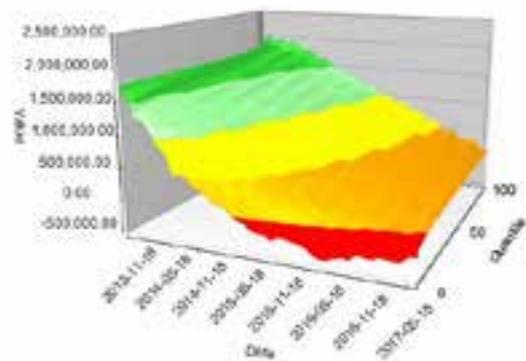
MVA corresponds to these recent regulations issued for margin rules for OTC derivatives, initial margin and variation margin. Essentially, the Standardized Approach to this is in its final form and will be in effect September 1st of next year. MVA is a pretty new concept, but by analogy with all of the other valuation adjustments—if you have a computation of margin, the effect of that computation should be included into your price, just like for the other valuation adjustments. The concept of MVA, though a relative newcomer into the valuation adjustment picture, naturally fits into the XVA valuation framework. The bottom-line: if we are going to account for initial margin, we should also account for MVA.

KVA

Also on the forefront is KVA. Though not yet required by regulators, KVA is recognized as the cost of holding bank capital against the risk of a trade on all dates into the future. KVA in fact is much more complex than CVA, DVA, or even FVA because KVA corresponds to aggregation of future capital for different types of risk—spanning from market and counterparty credit risk to operational risk in the future. To add to the complexity, KVA can be computed in different ways, with many methodologies currently in existence, including those using complex simulations. And, even for capital (capital as of today and required by regulators) different calculation approaches are being used amongst market participants. This is a very complex field, and ongoing research persists with active discussions amongst practitioners at conferences around the globe.

BEST PRACTICES: VISUALIZING EVA

Keeping all of this in mind, creating a trade profitability framework that brings all of the XVAs into trading decisions will enable better decision making amongst financial institutions. We all know by now that a trade that is profitable at first glance can turn out to be a loss-making trade when all costs are incorporated. Below are some best practices we recommend for visualizing EVA analytics in order to support more informed decision making with respect to trading and risk managing derivatives.



A) Exposure Profile

Since all XVA measures depend on exposure profiles, this is often one of the most important and basic view that traders and risk managers need to have. Also, while some of the XVA adjustments and measures can be complex and difficult to understand, the Exposure Profile is something that almost everyone intuitively understands as the matrix of future prices over time and over the number of Monte Carlo paths in the simulation. The Exposure Profile provides a method of analysis in which traders and risk managers can drill down and really see how a trade MtM can evolve and how the different XVA measures come about. This type of analysis tool is intuitive and easy to use—allowing one to drill down, debate and discuss trade profitability intelligently.

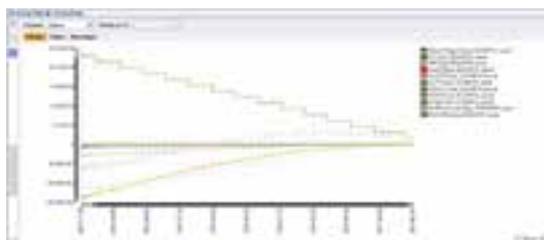


B) Trade Profitability Framework



The Trade Profitability Framework and Pricing Stack analysis in the diagram below provides another intuitive and easy-to-use framework for any type of user. It also enables users to drill down into trade cost components. Using this tool, practitioners can view which measures are high or low, and analyze these measures. In this example, we can observe that the CoRC is particularly high. This leads us to greater discussion and analysis about this component of the trade cost. Essentially, this tool enables practitioners to observe all the cost components and drill down as necessary so that one can make a more informed decision with respect to trading or risk managing derivatives.

C) Pricing Stack Evolution - Time Profile



Another useful view is the Pricing Stack Evolution or Time Profile analysis. This type of chart provides insights into how a trade EVA evolves over time. For this specific profile, we can observe that in 2015 and beyond, the trade EVA becomes positive. Also, we can observe that while the Client Margin is linear, the FVA

and CoRC measures are non-linear and fall more rapidly. Again, insights and analytics such as these open up discussions on how to create positive EVA from the outset.

LOOKING AHEAD: LEVERAGING INTEGRATED ANALYTICS AND REAL-TIME RISK

Viewing derivative trade profitability from the macro-level is no longer sufficient, given today's highly regulated, lower ROE environment. To survive and thrive in this new era of derivatives trading, today's practitioners need to adopt a more integrated and holistic approach for assessing trade profitability and allocating capital to their businesses.

In this article, we have highlighted the need for an integrated, granular framework for assessing trade profitability and allocating capital to businesses. The integration of risk and capital intelligence into trading— including intra-day or real-time pre-trade analysis is one of the most important ways to achieve efficiency for a derivatives operation.

Along the analytics continuum, if standard analytics sits to the left and predictive analytics sits to the right, then we envision the notion of agile analytics (consistent, flexible, scalable and responsive analytics) filling the gap in between. In addition, Cloud technology for risk management is increasingly being leveraged to dramatically reduce calculation times and provide faster results to facilitate more effective decision-making. We are also witnessing growing trends as far as using mobile devices and tablets for enterprise solutions. New risk systems and banking enterprise systems being deployed will need to be ready to run on any device, including web interfaces and will need to address issues of information security and ownership.

Moreover, with regulators and internal risk teams now requiring real-time results and enterprise-level risk assessment, today's



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financial institutions require consistent scenarios and analytical underpinning for business-critical activities – such as stress testing and limit setting capabilities, projecting capital into the future and observing how potential exposures will behave over time. There is a growing need for scenarios that are consistent across the traded markets, as well as the real world. Being able to use these consistent scenarios across the enterprise, and to generate projections based on those scenarios, will help institutions to calculate capital and reserves, allocate capital across the firm and enhance profitability.

Looking forward, updating risk infrastructure to handle stress tests as part of CCAR will continue to be top of the agenda. It's clear the regulatory mandate going forward is to conduct stress testing every quarter if not more frequently—and, therefore doing this manually is no longer an option. Banks that are able to automate stress tests will be better equipped to identify risks impacting their business.

Overall, using integrated analysis tools with drill down and real-time capabilities is essential for effective decision-making in today's complex derivatives trading arena. Integrating risk, collateral and capital costs into the front office opens the gateway for real efficiencies to be created within a derivatives operation.

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He holds an MBA degree from New York University's Stern School of Business, an MSc degree in Applied Statistics and Informatics from Indian Institute of Technology, Bombay and a BScin Mathematics and Computers from the University of Mumbai.

ABOUT NUMERIX

Numerix is the award winning, leading independent analytics institution providing cross-asset solutions for structuring, pre-trade price discovery, trade capture, valuation and portfolio management of derivatives and structured products. Since its inception in 1996, over 700 clients and 90 partners across more than 26 countries have come to rely on Numerix analytics for speed and accuracy in valuing and managing the most sophisticated financial instruments.

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Are XVAs Impacting Your Trade Profitability?

XVAs DEFINED: THE PROFITABILITY PUZZLE

CVA – Credit Valuation Adjustment

Valuation adjustment to a derivative price due to risk of a counterparty default

KVA – Capital Valuation Adjustment (a.k.a. Cost of Regulatory Capital)

Derivative valuation adjustment due to the cost of regulatory capital through the life of the contract

DVA – Debit Valuation Adjustment

Valuation adjustment to the price of a derivative contract due to one's own risk of default

FVA – Funding Valuation Adjustment

Valuation adjustment due to the funding cost implications of a trade not under perfect CSA



GROSS PROFIT

—

=

**EVA
ECONOMIC VALUE ADDED**

Collateral Cost (Bilateral)

Costs specific to non-centrally-cleared bilateral derivative transactions made between counterparties, including cost of collateral and Initial Margin

Overhead Costs

Necessary costs not directly attributable to a product (non-recoverable costs) including i.e. Legal, Advertising and Administrative costs

Cost of Transaction Tax

Includes the cost of transaction taxes on certain derivative-related financial transactions, which may increase in scope due to changing regulations

Cost of Margin (Cleared)

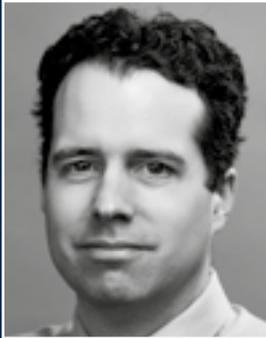
Costs specific to centrally cleared transactions, including adjustments for Initial Margin & Variation Margin

Product Costs

Initial and ongoing costs specific and attributable to the transaction, including hedging and other trade-specific costs

Empower your decision making with Numerix

Managing trade profitability with a complete understanding of the costs associated with the trade lifecycle is critical. Learn more about the XVAs and how market participants are empowering their decision making with Numerix. Read our article, "Empowered Decision Making: Integrating Risk into Pre-Trade Analysis." Go to www.numerix.com to learn more.



Negative Rates: The New Normal

Russell Goyder, PhD, Director of Quantitative Research and Development at Enterprise Valuation and Risk Platform Company, FINCAD

It was once widely believed that zero was the lowest interest rate possible. On face of it, it's not obvious why anyone would pay to lend someone money. But the current reality is that negative rates have become common in many European currencies.

While we have seen near-zero interest rates on both sides of the Atlantic for several years now, things got really interesting in 2014 when the European Central Bank's (ECB) benchmark rate, the Deposit Facility Rate (DFR), was set below zero.

This was by no means the first negative benchmark rate in Europe, as central banks including those of Switzerland, Sweden and Denmark had all moved into negative rate territory to maintain currency pegs. But the ECB's move was significant because it was the first to hit the Euro and the first meant as a direct stimulus measure.

Fast forward to March 2015, and a significant fraction, but still a minority, of Euro zone government debt had negative yields. Today, it's a majority and, as a result, the ECB has turned to quantitative easing.

Needless to say, the recent dip into a less than zero rates environment has introduced serious challenges for many financial institutions. Namely, the process of pricing and risk managing derivatives and bonds has become more complex since most firms' models and systems have been designed to assume non-negative rate dynamics.

OUTCOMES SO FAR

Despite the growth stimulus of negative interest rate policy, Europe's economy continues to face considerable challenges. Just one

example is the market turmoil that has erupted over whether Greece will remain a Eurozone member. Another is recent disappointing Eurozone GDP growth, which was less than half a percent in Q1 of this year.

All this means that negative rates are likely to hang around for a while, so we might as well get comfortable with them. This, however, can be a bit difficult since the concept is incredibly counterintuitive, even to the most experienced finance professionals.

That said, there is nothing fundamental that says interest rates must be positive. In any modern fractional reserve banking system, money is just a series of offsetting entries on the balance sheets of banks and businesses. Banks, in principle, do not care what interest rates are – they are quite at home with deeply negative rates, because their profits only depend on the spread between the rate they receive when they lend, and the rate they pay to their central bank.

If this theory sounds strange to you, you're not alone. The reason for your thinking is likely based on the concept of currency.

A ZERO INTEREST INVESTMENT?

One might ask themselves, why would I pay a bank to keep my money when I can hide it under my mattress for free? Taking a closer look, however, this storage method would not be free of course, because mattresses cost money, as do bedrooms. If you think about it, there is always a cost to storing, securing and managing physical cash. And currency constitutes only a small fraction of the total money supply. Even so, physical cash is what frames our thinking about interest rates. It singles out zero as a special interest rate.

So if you get rid of the concept of currency, you, in turn, get rid of the notion that zero is special. If that's going a little too far, how about just taxing currency, as proposed by Silvio Gesell in the 19th century? What if bank notes were only valid if they had this year's stamp, for which there is a fee?

Our political and cultural reality is that all of these measures are too radical to happen any time soon.

So, while the well-known "Zero Lower Bound" for interest rates has clearly been broken, there

is a new "Negative Lower Bound" that is its replacement. Today zero is no longer a hard boundary for interest rates, but a kind of soft boundary below which rates can dip a small amount.

PROBLEMS RESULTING FROM NEGATIVE RATES

Financial institutions have experienced some serious problems pertaining to risk management as interest rates have fallen below zero.

Case in point, there was tangible concern in the run-up to the negative rates experiment that money markets would fail to function. Banks went through thorough operational tests before the June 2015 announcement of a negative DFR. It took the industry a fair amount of work to finally persuade our machines that negative rates were in fact permitted.

Many firms have found that code or spreadsheets that reject negative interest rates are tedious to fix but relatively benign problems. As long as the underlying calculations work for negative rates, finding and fixing such bugs is relatively simple.

The more frightening prospect is code or spreadsheets that "helpfully" correct the negative rate for you, perhaps capping a discount factor at one or flooring a rate at zero. In this case, it's quite possible that other market participants will show you your error via a spike in demand for a particular trade before you are aware of a problem.

DANGERS OF LIMITED DIAGNOSTICS

If a firm's underlying calculations work for negative rates, then how do problems arise? Often the culprit is poor quality diagnostics. If diagnostics are limited, then it's easy to become overly energetic in your attempt to validate input up-front. Suppose we have a calculation that always works when given two correlations, each of which can take values between -1 and 1. Then the region of valid parameter space is square. This process seems simple enough—imposing that basic check on these two inputs assures us that our calculation will succeed. Or, does it?

Reality is rarely that simple. This graph shows the Feller condition for the Heston model,

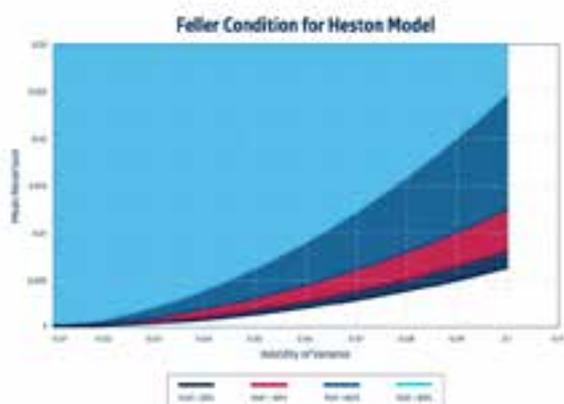


and therefore also any Local Stochastic Volatility model based on it. The valid region of parameter space is the shaded area above the curve – but which curve?

That depends on which long-term variance is chosen. And typically, we're not choosing values of these parameters – rather we are calibrating them. So what we are really interested in is the shape of the region of valid input to the calibration. That will be complicated in general. And of course the number of inputs to most financial calculations is typically many more than just two or three.

In general, determining, up-front, whether a set of inputs will work in a given calculation is at least as hard as solving the calculation problem in the first place. For this reason a more sophisticated approach is needed. This consists of validating inputs where possible, and where not, using strong contextual diagnostics available in a robust analytics system like FINCAD's F3 platform.

With high quality diagnostic information, it's much easier to avoid overzealous validation of input and strike the right balance between safety and flexibility – a balance missed by the authors of systems that required fixes to accept negative rates.



NEGATIVE RATES AND MODEL INCOMPATIBILITY

While firms' systems or spreadsheets can, for the most part, be adjusted to accept rates below zero, there are some models that simply don't work with negative interest rates. And, unfortunately, no amount of software engineering is going to help in this area.

The problem of models that are incompatible with today's negative rates environment is felt most acutely in the context of European swaptions, where SABR is the model of choice for building volatility (vol) cubes. Before you can calibrate a SABR vol cube, however, you will need to deal with swaption quotes, which traditionally have been encoded as implied volatilities.

Implied volatilities in which model, though? The canonical choice of the lognormal, or Black, model will not work for swaptions because negative values of the underlying swap rate are not admitted.

As a result, negative rates have prompted the trend of quoting vols in the shifted lognormal quoting convention, with a pre-specified shift. Unfortunately, many firms have found that the lognormal volatility function is so heavily embedded in their systems that changing it has been an extremely time-intensive process.

But, does it have to be this difficult? The answer is, no. It is possible to build systems where models can be altered without needing to writing code.

KEY CONSIDERATIONS FOR ANALYTICS ARCHITECTURE

To ensure that your models can be changed effortlessly, that is without coding, you need to give attention to three important concepts when developing your analytics architecture.

These include:

- **Product** - This aspect represents your trade or portfolio.
- **Model** - This includes a self-consistent collection of modeling assumptions. These take the form of calibrated model parameters and curves (i.e. discount curves, etc.)
- **Valuation Method** - For every product and model there are different choices about the numerical approach to entering calculations. This is known as the valuation method.

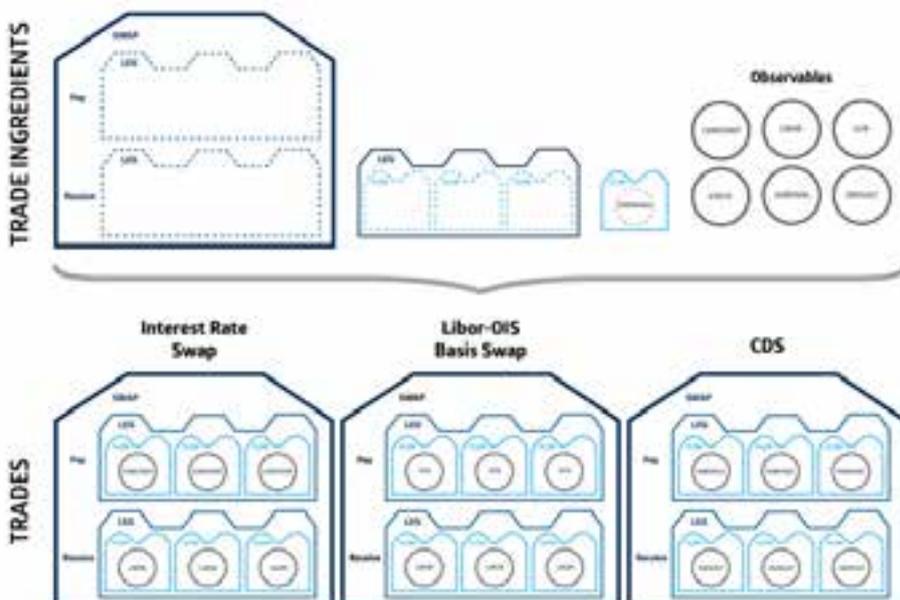
By factorizing the problem of valuation and risk measurement into these three concepts, firms can cover the space of possible calculations in a way that scales as the sum of each trade type, model and method, rather than the multiplicative product. This approach is therefore quite cost-effective.

To illustrate, let's take a look inside one of these concepts, the product. In traditional approaches to building analytics libraries,

you will find a pricer by pricer approach. This may include a swap pricer, a basis swap pricer, and a credit default swap (CDS) pricer among others. While this modular approach may introduce some efficiency, the extent to which you can achieve true modularity is limited.

The beauty of FINCAD's F3 platform is that it doesn't write pricers. Instead, it provides a tool that generates the appropriate pricers for you automatically from "lego bricks" as shown in the diagram.

By applying a lego brick approach throughout the analytics library, and generating pricers, not writing them by hand, firms gain analytics where trades, models and numerical methods can be "hot-swapped." This process is akin to changing hard drives in modern servers. When hot-swapping hard drives, you don't even need to power down a machine, you simply remove the old hard drive and easily replace it with another.





VALUE OF SABR

Now that you know how to change models without writing new code, you must determine which model specifically needs to be changed. For swaptions, it is the SABR model, as unfortunately it does not admit negative rates. But before beginning the process of picking a new model, it's worthwhile to take a step back and examine why SABR is so popular to begin with.

As a frame of reference, the following criteria are core to any strong model:

- **Good Fit** - If the potential model doesn't provide a good fit to market data, then it is useless.
- **Speed** - For liquid instruments, the model must be fast. This nearly always translates into some form of closed form solution or approximation.
- **Control** - Appropriate smile dynamics and control over the backbone are necessary.
- **Useful Parameters** - Orthogonal or independent model parameters are helpful in controlling the fit of the model. These parameters should be decoupled meaning, if you alter one, the others will remain unchanged.
- **Insight** - If there are two models equal in all other respects, but one has sound financial motivation, it will ultimately be more beneficial as it will bring more insight.

SABR is so popular because it fulfills the above criteria better than any other swaption model to date. However, it does not work in a negative rates environment so a change is therefore necessary.

AN ALTERNATIVE APPROACH

The advent of a completely new model may just introduce a fundamental shift in how we think about swaptions or volatility in general.

But given how entrenched the SABR model is in swaption markets, such a leap in innovation isn't likely to happen anytime soon.

However, over the past couple of years, there have been various attempts at modifying the SABR model to cope with low or negative interest rates. Unfortunately, none of these attempts offers the five core benefits that SABR does (fit, speed, control, useful parameters and insight). Each one introduces compromises in at least one area and sometimes more (e.g., the smile has unwelcome artifacts or slow PDE solvers, etc.). This has resulted in a very practical, yet not very elegant solution winning out. That is to shift the troublesome negative values into a positive range, and do SABR on those positive values.

The good news here is that the implementation cost of this is essentially zero compared to any other alternative because you can reuse your existing codebase. This is important since in many cases the SABR model is not used raw, but rather it forms the basis of bespoke proprietary tweaks, which all carry over into a shifted SABR scenario.

One drawback of merely shifting SABR is that it introduces a fifth model parameter, the shift. But then again, as the market quotes shifted lognormal volatilities, it already comes with a shift. But, you might ask, what if that shift changes as rates drop even more negative? Fortunately, we are not likely to see much change, given the Negative Lower Bound. In fact, the ECB recently announced 20 basis points as the official lower limit cutoff.

MODELING IN THE CURRENT ENVIRONMENT

If SABR is the model of choice for European swaptions in the current negative rates environment, then what about other volatility models? Indeed, there are some models that do admit negative interest rates.

As a point of reference, consider the diagram at right, which offers a brief survey of negative rate support in mostly interest rate term-structure models, both modern and historical. Models on the left admit negative rates, those on the right do not, and those in the middle can, depending on how they are parameterized. In fact, allowing negative rates has been a well known “drawback” of the models on the left for a long time. Industry thought leadership is overflowing with statements like “the possibility of negative rates can result in substantial mispricing” or “[negativity] is an undesirable trait in a nominal interest rate.” Such sentiments are reasonable at times of high interest rates, but what about now? Are Gaussian interest rate models like that of Hull and White the magic bullet we need to model rates in the current environment?

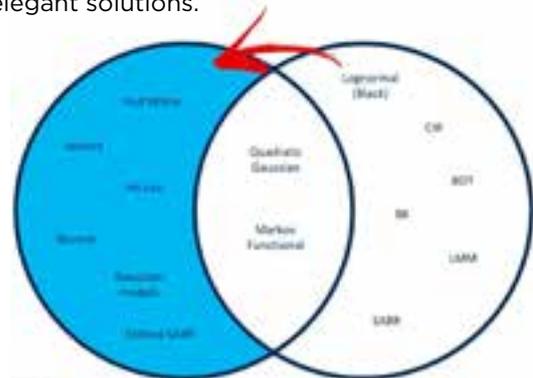


Likely not, since the zero lower bound has been replaced by the negative lower bound. The same concerns about distributing too much probability mass at unrealistically low rate levels still apply.

SHIFTING MODELS TO SUPPORT NEGATIVE RATES

Some industry participants have questioned whether the negative rates conundrum could be solved by merely shifting all the models on the right of this diagram. While this is a possibility for supporting negative rates,

unfortunately, it’s a messy one. SABR was shifted as a matter of practical necessity, and while there isn’t urgent pressure to do so elsewhere, quants will rightly strive for more elegant solutions.



An example that has been around for a decade is Fischer Black’s Shadow Rate approach, where we floor a fictitious “shadow rate” process at the lower bound, to form the observed rate process. Whenever the shadow rate process is below the lower bound, we get a prolonged period of low interest rates. This idea can be applied to any process, and back-testing in econometric studies has shown some decent fits to low interest rate data with a zero lower bound. But introducing a shadow rate complicates derivative pricing formulae to such an extent that the approach has not gained any traction in the front-office.

WEATHERING THE STORM

There is no denying that Europe’s great negative interest rate monetary policy experiment has caused some stormy waters over the past year.

Both small shops and large institutions alike have spent a lot of money and effort updating, fixing, re-engineering libraries, spreadsheets and systems to cope with the change. But it needn’t be this difficult.



For further information please contact info@fincad.com
or visit www.fincad.com

Today there are commercially available analytics solutions that let you weather much worse storms than negative rates. You just need to find the right system.

Key criteria to look for when evaluating such systems include:

- An appropriate treatment of inputs, with contextual diagnostics
- Flexible curve - building capabilities that not only handle negative rates, but allow any curve to be built from any market instrument
- Sophisticated analytics that support multi-currency CSAs, bespoke funding spreads and determining an optimal clearing strategy given the CME-LCH basis
- A platform built around the three key concepts - Product, Model and Valuation Method, enabling you to transition your modeling from the old to new approach, with zero pain

It's important to remember that storms keep coming. Whether it's OIS discounting, negative interest rates or the next upheaval lurking in the wings, times will continue to change—and models will come and go. It's only with a truly future-proof enterprise valuation and risk platform that you can take these changes in stride, and maintain your competitive edge.



Russell Goyder, PhD. is director of quantitative research and development at Enterprise Valuation and Risk Platform Company, FINCAD.

He manages the quant team and oversees the delivery of analytics functionality in FINCAD products, from initial research to the deployment of production code. Before joining the Vancouver, Canada-based company in 2006, Goyder worked as a consultant at The MathWorks. He holds a PhD in physics from the University of Cambridge.

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OK, so you've launched a fund. Now what?

A new hedge fund, first and foremost, needs to raise investment. There are a many factors which differentiate a successful investment round from an unsuccessful one, not least the experience of the fund managers, and whether the proposed strategy is convincing. **All funds however need to demonstrate best practice around their risk.** In the past this was perhaps less of an issue, but that all changed in September 2008 when the willingness of regulators to exclude the buy side from the more stringent requirements of the sell side collapsed along with the market. In 2010, in the US, this became set in stone through the Dodd-Frank act. Now US hedge fund advisers with assets under management in excess of \$100 million (or \$150 million if a private client fund) are required to register with the SEC. Whilst most startup funds are exempt at initiation, most investors would want to see that the new fund was well placed to address the regulatory hurdles as and when they applied. So, from the get go, **a new fund needs to demonstrate the existence of a validated risk system.**

You need a risk system. Do you build or buy?

You need a risk system. Do you hire some quants and techies to put it all together, or do you buy off the shelf? Many new funds opt for the latter. In fact, they're more or less forced



to as not only do they need to show that they have a risk system, but that it is a validated one. Whilst it may seem more economical to try to put this together yourself, the economy is false. Those guys aren't going to work for nothing. The common price tag on an experienced quant is certainly going to be in excess of \$150,000 per year, and the same is true of an experienced IT contractor. And then you're going to need a portfolio management system, a risk system sitting on top of that, connectivity to market data feeds and possibly an order management system.

This all takes considerable time and effort to construct, to say nothing of test. And to demonstrate that the system is sound you're going to need to validate against third parties anyway. By the time you're done, and your investors convinced that the system you've constructed is indeed sound, you'll probably be down several hundred thousand dollars. That's coming from your own pocket, and that hurts.

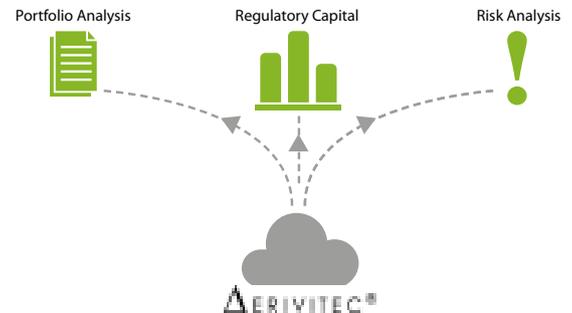
So, you buy off the shelf. You get a portfolio management system and a risk system which somehow communicates with it. Commonly that system is going to be multiple systems, e.g. one for handling value-at-risk, one for handling intraday pre-trade risk analysis. You glue in your market data feed APIs and you're all set. But what have you got now? Multiple systems, some with complex on premises installation (and an associated on going price tag for keeping that installation up to date) with some sort of manual process to link it all together. It's common to find funds using three systems talking to each other by means of normalised flat files so the systems can understand each other. So even though the funds are demonstrating best practice in putting together a validated system, there is still **un-validated manual intervention going on to get it all to work. In a sense, these funds are only marginally better off, in practice, from where they would have been had they built it all themselves.**

So is there no solution?

You appear to have only two options. You can build it yourself, and get clamped down on by your auditors, or you can **buy off the shelf and pay a lot of money out of your own pocket before a dollar of investment has hit your fund.**

But there is another way.

Supposing you just paid a validated third party for what you need, when you need it, and no more. Let's see how this would work...



STEP 1

YOU, THE FUND MANAGER, CHECK OUT THE PAY-AS-YOU-GO SOFTWARE.

The first 30 days, at least, is going to be free. So you download the software and see what it does. Hold on, download? Doesn't that mean that my system might break, unless I pay some guy from the vendor to come along and check the installation with me? That sounds just as bad as going to any of those other traditional vendors and trying out their free trial. Right. You shouldn't have to download anything. You should be able to register on the web and check out the software from a browser. On your Mac, or your Windows PC, or your mobile device, anywhere, anytime.

But is it secure?

This is a question you should be asking, and you should require proof that your concerns are addressed. Here are a few pointers:

- a) Is web transport encrypted?
- b) Does the application come with the option to two factor authenticate?
- c) Has the application been security checked by a validated third party?
- d) Is sensitive data encrypted?
- e) Does the vendor manage their own security properly with properly tested backup and restore procedures?

There are lots of other considerations an IT security professional could list, but the questions above are certainly ones you should get clear answers to. Over and above that, is the cloud provider secure? The big providers like Microsoft have invested a great deal to ensure



that the data centres themselves are indeed secure, and you can read about this in more detail at <http://azure.microsoft.com/en-gb/support/trust-center/compliance/>.

So yes, it is secure, provided the vendor has done their homework. As with procurement from any vendor however, it's up to you to check.

STEP 2

YOU'RE IN, NOW WHAT DOES THIS STUFF DO?

Does this stuff value my portfolio correctly? Upload your portfolio and see. In the trial stage, an Excel upload is a must.



As you integrate the software with your day to day workflow you'll want to tie into your brokers' feeds, but that can come later. Let's say that this platform does allow you to upload your trades, can you just go calc them? Do you now need to get a market data vendor in to hook up a data feed, or does this system allow you to do that seamlessly? Better still, does it provide market data out of the box? And not just raw market data. That's ok as far as it goes but you're still going to need to do a bit of quant gymnastics to get it into a form a model can understand. The system should, at the very least, be able to provide you with **model ready derived data** either through integration and back end processing with one of your existing market data vendors, or out of the box. The latter is probably going to be end of day rolled to today, but that's going to be a good start. You can move onto delayed and live pricing later through integration with a market data vendor under a separate license. The system should also make that seamless.

STEP 3

LOOK AT THE NUMBERS.

Not just look, but **really** look. What's behind that price? To satisfy yourself that the system is validated you're going to want to **drill** down into any report it generates. In fact, you should compare the numbers from another third party, so the system had better come with an export tool, ideally to Excel. The model should be fully documented, with all the assumptions and methodology listed in full technical detail.

STEP 4

MANAGE THE PORTFOLIO.

You're not going to want to import from Excel all the time. You're going to want to manage your portfolios in the application and be able to reconstruct them for any point in time. Try doing that in Excel. It's messy and hard to audit. The system should make this trivial and transparent.

STEP 5

ANALYSE A NEW TRADE.

Let's suppose that the system can do all this. Now you're going to want to book a new trade you **might** put on that day. You could upload again of course, but that's not exactly great for pre-trade analysis. The system should allow you to try things out. Take the trade you're thinking of putting on and stress it. See how the hedges look if vols spike up, or spot tanks. Can you handle it? Would you breach your trading limits? The system should allow you to take a good look at the trade **before** you put it on and then allow you to book through your portfolio management system (PMS) when you're happy.

STEP 6

GET SOMEONE ELSE IN YOUR FUND TO TAKE A LOOK.

You're now going to want to share information. This is actually going to be easy, as the platform is web based, so in the same way I can share my latest home video with my social media contacts, I should be able to do that with this system. So, you go ahead and share the portfolio you've been working on with the trader at a level you deem appropriate. You're probably going to allow them to see everything in it, including the book structure, but you might not want them to look into it. Alternatively you might want to transfer management entirely, and allow them to share the portfolio as they deem appropriate. The choice will be yours.

STEP 7

SHARE OUTSIDE THE FUND.

Remember those investors? Let them see what you're doing. The quickest audit is the one where the auditor can see every detail of your numbers. So show them. Invite them to use the platform and allow them to drill into the numbers, same as you. Of course you may not want them to see your underlying book structure, so share only at the portfolio rather than the book level. That's ok because they'll still get the same aggregated numbers. Come to that, why just investors? Why not brokers, administrators, auditors, custodians, fund of funds managers, regulators? **A platform like this puts everyone on the same page.** Fund managers frequently complain about the difficulty of aggregating risk from different brokers, another by-product of the risk diversification required post 2008. If you're all using the same system, and can share through that system, the problem of aggregation is solved by **construction**. Of course, if you want

to start with broker feeds for the moment, the system should also allow you to do that, processing and normalising in the back end. But imagine, ultimately, that you're all using one system. How cool would that be?

STEP 8

GROW.

Now you grow the fund. Can the system cope? Yes, on two conditions:

First, the system must be scalable. Your vendor should never tell you that the system can't cope, or whack a bill on you for buying new servers to make it cope. The system should just be able to consume more resource, regardless of how complex and time consuming your calculation requirements are. This is what the Cloud is all about. People sometimes refer to private data centres as 'private clouds'. A private cloud is not a cloud, it's a data centre.



A cloud is a network of virtual machines which can be scaled up and down according to your needs. Sure, it sits in data centres, but they are so big, and globally distributed, that resources should never be an issue. If your vendor hosts in the cloud, they are basically renting this scalable resource, and should pass the savings onto you.

Second, the system must be **agile**. Regulation is changing all the time. Most traditional vendors are struggling to keep up. But you have a web based system. This means that you can work with the vendor, directly, through their user test platform, and get new requirements integrated into their production release in days, not months. Modern web applications are set up to deploy to production



continuously. All code changes are subjected to a continuously evolving set of tests designed to prove that incremental changes are stable and backwardly compatible. Because the tests are run with every code change, and because the code is typically modified on a daily basis, the need for an operationally expensive release is obviated. What this means is that if you need extra functionality quickly, the system can deliver quickly **and** involve you at every step of the way. How many vendors do you know who can do that?

STEP 9

PAY.

OK, this all sounds great, but isn't it going to be just as expensive as an existing vendor? Eventually, yes. When you're a \$1bn fund with thousands of trades, an army of traders consuming data on a mass of assets classes from all over the world, sure. But not now.

Why pay for what you don't use?

Most vendors provide an awful lot of what you don't need and can't adapt quickly to what you do. You, as a startup fund manager should pay the base package for the traders using your system, for as long as you use it, **and no longer.** You shouldn't be locked in, and you should be able to scale down your costs if one of your traders stops using the system, for example. The vendor who's put this together is optimising their costs every day. They don't have to send people out to install the software, they don't have to manage your database on your premises, and they don't have to deal with multiple versions. You should expect the savings to be passed on to you. Now, as the number of trades you value goes up, and your calculation requirements increase correspondingly you should expect to be charged more, but **fairly.** As more and more companies choose to deliver software this way,

competition is driving the costs further down, constantly. Adopt this model now and you'll be optimising your IT cost base not only today, but for the duration of your fund.

CONCLUSION

The world of financial software has changed out of all recognition compared to only a few years ago, but not enough players in the financial industry are taking advantage of these changes. Software is more agile, cheaper, available and convenient than it has ever been. As a new fund manager you are in the unique position of getting this right from day one. Embrace the new technology now and benefit for years to come.





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