Bringing Real-time Risk into the Decision-making Process

December 2015

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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.

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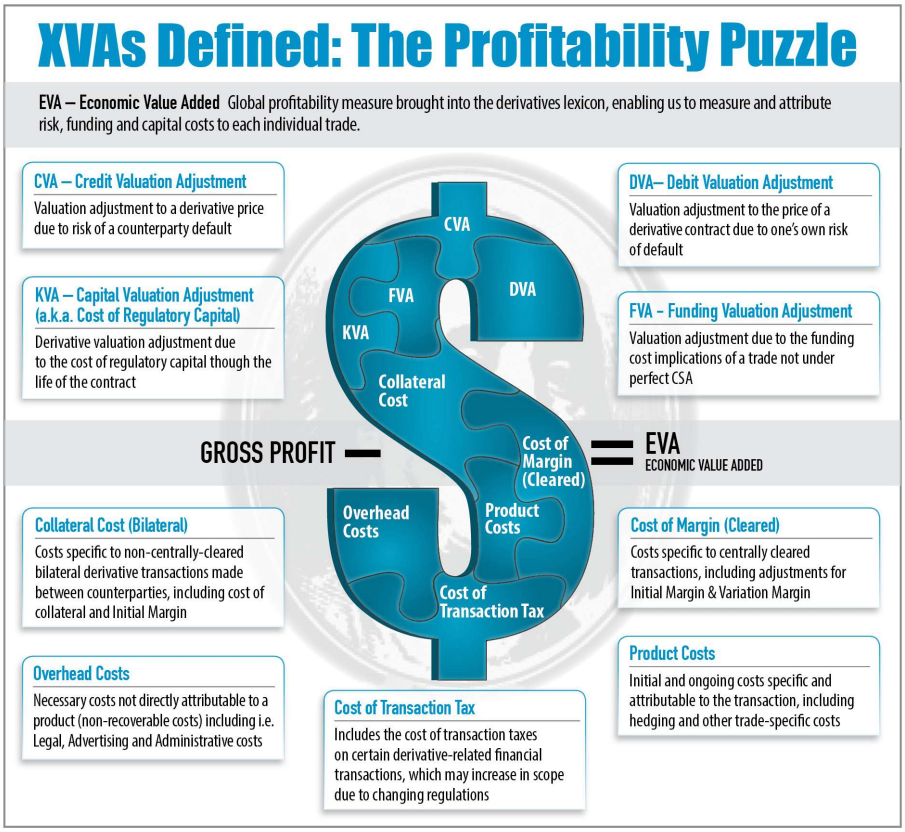
To adapt to all of these shifting regulations and requirements, the market is embracing a more integrated and holistic approach for managing risk, along with a shifting focus towards optimizing business lines and trade activity. Looking ahead, we see a flurry of activity surrounding the development of 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.

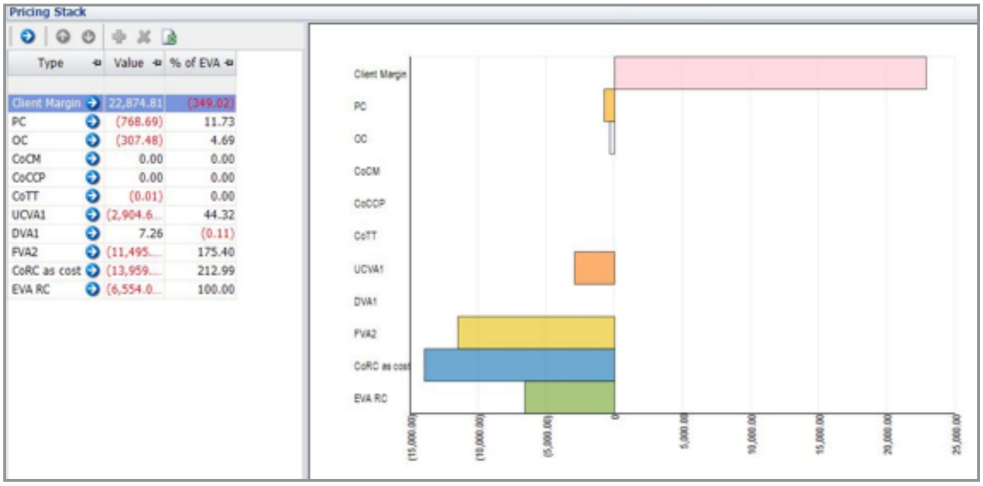
As the XVA valuation framework continues to evolve, today's derivative practitioners continue to face a new slew of complicated computational and other challenges as they work hard to achieve their end goal—profitability. With ever-increasing regulations being implemented and rolled-out, what should 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 receivables + FVA payables = FCA + FBA

Funding Cost Adjustment:

FCA = (uncollateralized derivatives receivables) * (duration) * (self funding borrowing spread over Libor)

Funding Benefit Adjustment:

FBA = (uncollateralized derivatives payables) * (duration) * (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 ~ = 8% x RWA x 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.

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

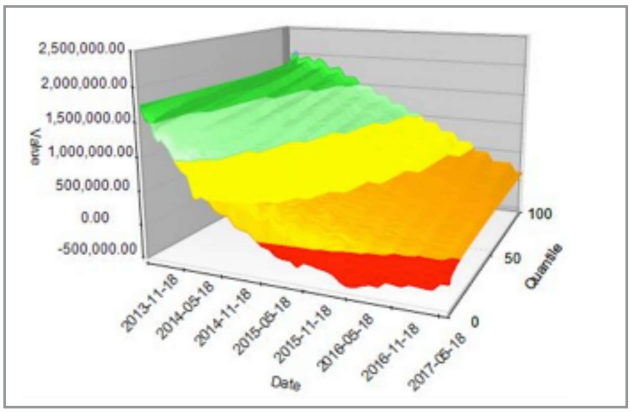
Also on the forefront is KVA. Though not yet required by regulators, KVA is recognized as the cost of holding bank capital against the risk of a trade on all dates into the future. KVA in fact is much more complex than CVA, DVA, or even FVA because KVA corresponds to aggregation of future capital for 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.

[1]Revisions 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

BEST PRACTICES: VISUALIZING EVA

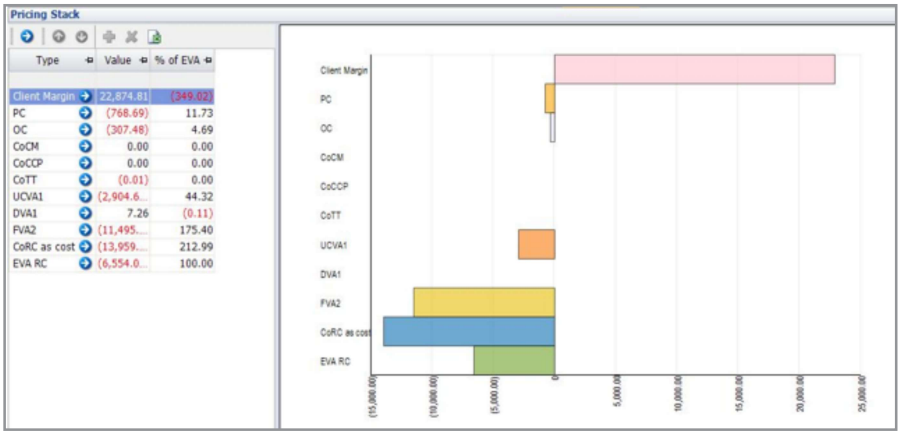
Keeping all of this in mind, creating a trade profitability framework that brings all of the XVAs into trading decisions will enable better decision making amongst financial institutions. We all know by now that a trade that is profitable at first glance can turn out to be a loss-making trade when all 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



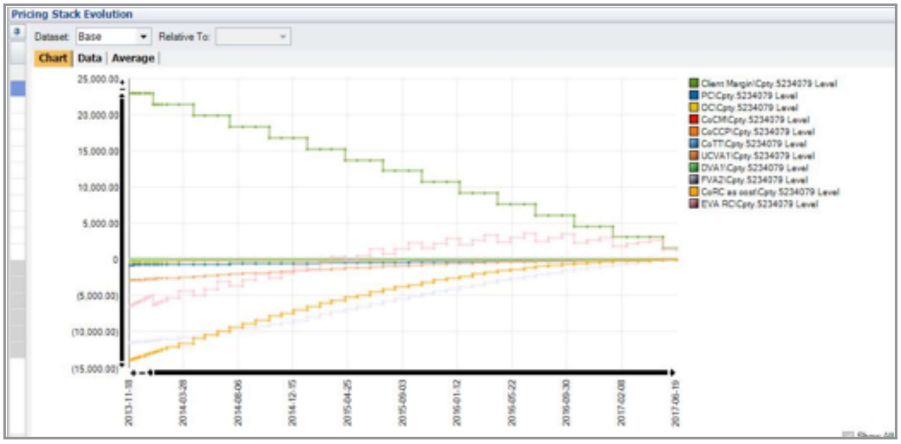
Since all XVA measures depend on exposure profiles, this is often one of the most important and basic view that traders and risk managers need to have. Also, while some of the XVA adjustments and measures can be complex and difficult to understand, the Exposure Profile is something that almost everyone 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 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 identity 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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Mr. Kancharla, as Chief Strategy Officer and Senior Vice President, is responsible for corporate strategy and currently heads the Client Solutions Group at Numerix. 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.

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