FINASTRA

TREASURY AND CAPITAL MARKETS: PRICING AND RISK METRICS GUIDE

LINEAR INTEREST RATE SERIES

Part 1: Single Currency Curve Construction

THE FUTURE OF FINANCE IS OPEN

CONTENTS

EXECUTIVE SUMMARY

The global financial crisis that began in 2007 triggered a paradigm shift in the way derivative transactions were valued. It became clear the historical precedent at the time of using a single LIBOR curve for projection and discounting was inappropriate. As the financial crisis hit, IBORs started to price an increase in the perceived credit and liquidity risk of financial institutions, causing a significant widening of LIBOR rates versus OIS rates.

We hope you find this paper on understanding single currency curve construction useful. For more information on how we can help with your risk management, please contact us at capitalmarkets@finastra.com or visit us at finastra.com.

A Historical Look Into the Widening of LIBOR Rates Versus OIS Rates

Accurate valuation in a post-2008 environment demands a multiple curve framework in a given single currency that:

- Incorporates projection curves that include tenor basis spread adjustments. This is a reflection of significant moves in tenor basis swap spreads during the crisis as a reflection of market re-pricing of term funding risk in a funding stress situation.
- Reflects the shift from deposit (LIBOR) to Overnight Index Swap (OIS) funding through the adoption of the OIS curves for discounting derivatives and future cashflows. In a pre-crisis world, LIBOR was widely accepted as a low-risk rate for discounting.

As the financial crisis hit, IBORs started to price in the perceived credit and liquidity risk of financial institutions, causing a significant widening of LIBOR rates versus OIS rates. The daily tenor nature of OIS swap rates minimizes the effect of credit and liquidity risk. Additionally, OIS rates were increasingly adopted as the funding rate for discounting collateralized derivatives (under collateralized CSAs).

Further, post-2008, market participants were forced to migrate certain derivative trades to clearing venues as a way of reducing systematic credit risk in the derivatives market. Market participants need to post initial and variation margin to clearing houses which earn the OIS rate. Hence, the OIS rate is the discounting rate for cleared trades as well.

Before 2008, the normal method of bootstrapping an interest rate swap curve relied on the fact that the interest rate curve generation (thereafter called the IBOR curve) and the discount curve were identical. With identical discounting and IBOR curves, a single set of fixed vs floating interest rate swap rates would be sufficient to bootstrap the IBOR curve.

With the adoption of OIS discounting methodology, a different method of bootstrapping becomes necessary. In essence, interbank instruments used to build a swap curve are collateralized and hence OIS discounting is appropriate, as this is the rate of return on the collateral. This means that OIS and LIBOR curves need to be bootstrapped simultaneously.

For instance, in the USD market, to price a cleared LIBOR swap one needs the LIBOR curve to forecast forward rates and the Fed Funds curve for discounting. If the Fed Funds curve is known, the LIBOR curve can be solved to reproduce the cleared swap quotes. But to solve for the Fed Funds curve using the benchmark basis swap quotes for Fed Funds versus LIBOR, one first needs the LIBOR curve. This circular dependence makes it necessary to build the Fed Funds and LIBOR curves simultaneously.

It is important that the single currency swap curve construction methodology exhibits the following properties: i) Liquid instruments should be repriced ii) Illiquid instruments should be priced consistent with liquid instruments iii) Model implied risk should be stable.

The purpose of this paper is to describe:

- the construction of a multi-curve construction framework within a given single currency;
- the nature of curve calibration instruments;
- and the mathematical techniques and considerations in constructing such curves.

For ease demonstrating single currency curve construction, we will detail the methodology for constructing a USD cleared swap curve.

When Discussing USD Yield Curve Construction, the Following 7 Points are Important to Consider

1. The LIBOR projection curve should only be built using instruments with 3m LIBOR dependency. Note, tenor basis swaps in USD should be used to infer the 1m, 6m, 12m LIBOR curves only after the dual 3m LIBOR-OIS bootstrapping methodology is applied.
2. We recommend using an initial FRA followed by one and half years of Eurodollar futures (which are much more liquid than the FRAs). If the 3M LIBOR fixing is known for the curve generation date, it is used for the contractual reset of the interest rate swaps and if not, the swap rate is reset with the 0x3M FRA. Note, 3m LIBOR interest rate future contracts are not discounted but there is a Eurodollar futures vs FRA convexity correction which needs to be applied to the implied rates from the Eurodollar futures to transform futures prices into a 3M forward rate. This is to ensure that swaps and FRAs are priced correctly.
3. After the futures, there are seventeen LIBOR swaps out to 30yrs. The main rates still trade on interest rate swaps indexed to LIBOR, so these need to be discounted. These swap rates are quoted as a spread to the benchmark US Treasuries. It is typically the case that the US Treasury bond prices are supplied to the curve construction mechanism and in turn these prices are converted to bond yields. It is typical that for swap maturities that lie between two US Treasury maturities, the implied bond yield for that swap maturity would be linearly interpolated in the time- to-maturity dimension. The Swap vs Bond Spread is then added on top.
4. As an alternative to bond yield inputs, it is common to use direct swap quotes instead if they are deemed to be more liquid. This means that in practice in US time zones where Treasuries are more liquid, the method of spread to Treasuries seems to be most prevalent in the dealer street whilst in European time zones, direct swap quotes are used.
5. The monthly Fed funds futures are then used to one year. Note, each contract settles on the average of the Fed funds rate of the preceding thirty days.
6. Basis swaps (Fed Funds vs 3M LIBOR) are then used out to thirty years. The Fed funds leg pays the quarterly arithmetic average of the daily Fed funds rate for the past three months plus the market-quoted basis swap spread. Another possible instrument is the OIS swap (which consists of a fixed vs daily compounded Fed funds rate). On the longer end, the basis quotes are more liquid and stable than the OIS swap (which is simply a derived quantity from the Libor swap market the Fed funds vs 3M LIBOR basis swap market). Alternatively, some clients use central bank meeting date swaps. These are forward starting swaps.
7. It is common to account for turn rate adjustments to account for seasonality at month-end, quarter-end or year-end or on dates with large structural flows (e.g. related to personal income tax date deadlines). These are described in more detail later.

The following are the recommended instruments for a building a USD cleared swap curve:

Bond Futures	3M Libor				Fed Funds		Fixings
	Treasuries	Swap Spreads or Vanilla Swaps	Futures	FRA	Futures	Basis Swaps Fed Funds v 3M Libor	
2Y	OTR 2Y	2Y	EDc1*	0X3M Spot	FF1	2Y	3M Libor
5Y	OTR 3Y	3Y	EDc2*		FF2	3Y	Fed Funds
10Y	OTR 5Y	4Y	EDc3*		FF3	4Y	
30Y	OTR 7Y	5Y	ED1		FF4	5Y	
	OTR 10Y	6Y	ED2		FF5	6Y	
	OTR 30Y	7Y	ED3		FF6	7Y	
		8Y	ED4		FF7	8Y	
		9Y	ED5		FF8	9Y	
		10Y	ED6		FF9	10Y	
		12Y			FF10	12Y	
		15Y			FF11	15Y	
		20Y			FF12	20Y	
		25Y				25Y	
		30Y				30Y	
		40Y				40Y	

* Depending on liquidity

The recommended approach is to build the Fed funds and LIBOR curve simultaneously using a multi-dimensional optimization routine.

Having determined the 3M LIBOR projection curve and also the OIS discount curve using the dual bootstrapping approach above, it is then recommended to build the 1M, 6M, 12M USD LIBOR projection curves using the additional USD tenor basis swap market data (3m vs 1m, 6m vs 3m, 6m vs 12m pairs).

It is common practice to use the LCH as the base clearing house and the LCH LIBOR projection and OIS discounting curve is produced from LCH cleared instruments initially. Given the LCH OIS curve and calibration instruments in the other clearing houses, the LIBOR projection curve in other clearing houses is inferred (this is tantamount to producing a LIBOR projection basis adjustment on the LCH LIBOR projection curve).

03 CALIBRATION INSTRUMENTS

3m Interest Rate Futures

Deposit futures are financial derivatives written on a deposit that starts on the Spot Date after the futures settlement date and then continues for the underlying tenor of the deposit.

The non-convexity corrected futures rate is given by the following:

$$R = 1 - \frac{Futures\ Price}{100}$$

Example: Eurodollar futures contracts in USD are an example of a deposit futures contract.

These instruments are used for the intermediate part of the curve as they are more liquid versus FRAs and provide information on the LIBOR projection curve in the intermediate sector of the curve. These instruments do not need to discounted.

Fed Funds Futures

Fed funds futures trade on the CME with monthly expiries and are written on the average of the Fed funds rate over the preceding thirty days. These instruments provide information on the OIS discounting rate for the short end of the curve.

Forward-Rate Agreements (FRAs)

A forward rate agreement is a cash-settled OTC contract between two counterparties, where the buyer is borrowing (and the seller is lending) a notional sum at fixed interest rate (the FRA rate) and for a specified period of time starting at an agreed future date.

A FRA is basically a forward starting loan, but without an exchange of principal. The notional is simply used to calculate the interest payment. By enabling market participants to trade today at an interest rate that will be effective at some point in the future, FRAs allow them to hedge their interest rate exposure on future engagements.

The market quotes forward rates between FRA start and FRA end dates. The determination of FRA start and FRA end dates follows the following convention in major currencies: a) Spot Date + Start Tenor b) Spot Date + End Tenor. For instance, a 6x9 FRA will have a start date which is 6m from the Spot Date and end date which is 9m from the Spot Date.

These instruments are less liquid than the Eurodollar futures, which are used to build the intermediate part of the LIBOR projection curve.

FRA vs Deposit Futures Convexity Correction

The daily margining of futures markets makes deposits futures unfavorable to the party which is long the futures contract vis-à-vis the equivalent (rec fix/pay float FRA). Hence the party long the futures contract would demand a higher rate than compared to the FRA rate. The difference is known as the FRA vs Futures convexity correction.

In the spot probability measure, the NPV of a contract that pays $X(T)$ at its terminal date is equal to:

$$\boldsymbol{X(t) = E^{Q_0}[X(T)e^{-\int_t^T r(u)du}]}$$

where:

$X(T)$ = terminal payout at future time T

$r(u)$ = instantaneous short rate at future time u

Applying this result to the futures price we obtain the following result:

$$Fut_t = E^{Q_0}[F(T, T, T_{Exp})]$$

where:

T = expiry of the underlying futures

T_{Exp} = expiry of the deposit contract underlying the futures

Hence, the futures vs deposit futures convexity correction is given by the following:

$$Convexity\ Correction = E^{Q_0}[F(T, T_{Exp})] - E^{Q_{T_{Exp}}}[F(T, T_{exp})]$$

where:

Q_0 = spot probability measure

$Q_{T_{Exp}}$ = zero coupon bond maturing at T_{Exp} probability measure

In order to compute the convexity correction, it is necessary to make some distributional assumption for the dynamics of the underlying interest rates. It is typical in the dealer street to assume a one factor or two factor Linear Gaussian Model (LGM) and to mark the model parameters such that model-implied FRA vs deposit futures are at market. For simplicity reasons, many banks just get the convexity price from the market.

Fixed vs Floating Interest Rate Swaps

A fixed vs float interest rate swap is a derivative contract which specifies the nature of exchange payments benchmarked against an interest rate index. In a fixed vs float interest rate swap, one party agrees to make payments to another based on an initially agreed fixed rate of interest, to receive back payments based on a floating interest rate index. Each of these series of payments is termed a 'leg', so a typical interest rate swap has a fixed leg and a floating leg.

The floating index is typically known as an interbank offered rate (IBOR) of a specific tenor in the appropriate currency of the interest rate swap. The following structural features of an interest rate swap must be defined: notional, start and end dates of the schedule, the fixed rate, floating rate index, day count conventions for interest calculations.

A fixed vs float interest rate swap is simply a string of the embedded forward rate agreements. Hence, the mid-market swap rate is a weighted average of the embedded mid-market FRA rates. Fixed vs float interest rate swaps trade in the interbank market as collateralized instruments. Hence, the NPV of the fixed leg is a function of the OIS discounting curve in the fixed rate currency and the floating leg is a function of the LIBOR projection curve and the OIS discounting curve.

The long end of the yield curve is built using fixed vs float interest rate swaps as these are the most liquid long end instruments. There is an IBOR index in each IR fixed/float swap market currency which is most liquid and from which the base IBOR projection curve in that currency is built. These instruments allow us to build an IBOR projection and OIS discounting curve in the long end of the curve.

Tenor Basis Swaps

A tenor basis swap is a type of swap agreement in which two parties swap variable interest rates based on different money market reference rates, usually to limit the interest rate risk that a company faces as a result of having different lending and borrowing rates of different tenors. For example, in USD you could enter into a tenor basis swap which exchanges 3m USD LIBOR vs 6m USD LIBOR. Tenor basis swaps in the interbank market are collateralized instruments.

Given the IBOR projection curve in the most liquid/standard IBOR index derived from the fixed/float interest rate swap market and the OIS curve in that currency, one can derive an IBOR projection curve in the non-standard IBOR index in that currency.

OIS vs Fixed Interest Rate Swaps

An Overnight Index Swap (OIS) is a fixed-floating interest rate swap where the floating rate is indexed to an overnight index rate (normally, a cash-collateralized central bank accommodation rate, or in some countries, an interbank rate for the most creditworthy of banks). The floating rate index rates in major markets are the Fed Funds Rate (USD), SONIA (GBP) and EONIA (EUR). The fixed rate for OIS trades is normally a simple rate with interest at maturity for OIS's with maturity of less than 1 year and for OIS's longer than 1 year, the fixed rate is an annual fixed rate. The property of OIS reference rates is that they are relatively constant between central bank meeting dates particularly when the rate is closely tied to the central bank rate. This is a direct consequence of the market rate only being changed on the central bank meeting dates.

Most OIS markets use an ISDA standard for computing the floating interest rate during an interest period. This standard is equivalent to interest compounding on a business day basis:

$$Int = Nom[\prod_{i=1}^{d_n}\left(1+\frac{n_i REF_i}{d_y}\right)-1]$$

where:

Int = Total Interest

Nom = Nominal amount which is daily compounded

d_n = the number of business days in the interest rate period

d_y = the number of days in the year which is normal for that currency

n_i = number of days between the business day d_i and the next business day

REF_i = reference rate for business day i (valid until the next business day), normally published on business day i +1.

Note, the final settlement of an OIS occurs a day after the maturity date of the OIS because of the delay in publishing the reference rate for maturity date (the next morning).

These instruments could be used to infer the intermediate part of the OIS curve. In practice, then Fed Funds vs Libor basis swaps (which are much more liquid and stable) are used to build the intermediate part of the OIS curve.

Fed Funds vs LIBOR Basis Swaps

Fed Funds vs 3M LIBOR basis swaps exchange the quarterly arithmetic average of the daily Fed Funds rate for past three months plus the market-quoted basis swap spread against 3M LIBOR. These instruments are used to build the intermediate part of the OIS curve due to their high liquidity and stability.

There are a Large Number of Possible OIS and LIBOR Curves that can fit the Market Calibration Instruments

The choice of the curve boils to a choice of interpolation and extrapolation regime. The following are desirable properties in the construction of a yield curve:

1. One needs to be careful that the curve is not over-constrained otherwise the yield curve may end up with unrealistic model implied points between the calibration instruments.
2. The yield curve should be smooth and should not exhibit unreasonable jumps.
3. The forward curve should be built by compounding daily rates to avoid arbitrage. The front end of the curve should really be a step-up function as the 3M index is nothing but all the previous overnight plus as spread, due to liquidity or credit risk. Hence, one needs to be able to build curves where the shape of the overnight is what matters.
4. The Fed funds rate is expected to be constant between the Fed meeting dates. This is equivalent to the assumption that the instantaneous forwards are piecewise constant (or equivalently the log of the discount factors is piecewise constant). Hence, care needs to be taken in order to construct forward Fed funds rates that are piece-wise constant between Fed meeting dates and exhibit a possible jump on Fed meeting dates. In Appendix A, we advocate an approach for this problem suggested by Justin Clark.
5. Central bank dates are announced only up to a certain near-term schedule. As a consequence, the longer end of the curve is driven by Fed Funds vs LIBOR basis swaps and LIBOR fixed-float interest rate swaps, where a smoother shape is expected due to an averaging effect of several anticipated Fed meeting dates in the future (which are more uncertain than the short end). Smooth shapes on the long end of the yield curve can be achieved using a standard cubic spline on the log of the discount factors (which implies that the instantaneous forwards are a quadratic function). One of the issues of cubic splines is that a local change in market prices at one end of the curve may cause undesirable side-effects on other sections of the curve.
6. There needs to be a smooth join between the front end of the curve (heavily driven by central bank activity) and the longer end of the curve. This can be achieved by starting the cubic spline with points in the front end of the yield curve.
7. It is recommended to take account of turn rate adjustments to account for seasonality at month-end, quarter-end or year-end or on dates with large structural flows. We can define a turn rate spike curve, $r_{turn}(s)$, mathematically as follows:

   $$r_{turn}(s) = \sum_i I_i(s).\,\delta_i(s)$$

   where:

   $r_{turn}(s)$ = turn rate adjustment at time s

   $I_i(s)$ = indicator function for the jump i

   $\delta_i(s)$ = spike height applicable for jump i

8. Products like interest rate swaps are traded between counterparties and cleared at a pre-agreed clearing house. The trades could be cleared at any of the various clearing houses, for example LCH, CME, JSCC. The same swap trades at different prices in both markets owing to differences in composition of the initial margin charges etc. In order to account for this dispersion, we recommend the base discount and projection curves are constructed for LCH initially (which is the base clearing house). Given the LCH OIS curve and the cleared instruments in the other clearing houses, one can then infer the clearing basis as a margin to the LCH LIBOR projection curve for each of the other clearing houses.

REFERENCES

Bruce Tuckman and Pedro Porfirio, **Interest Rate Parity, Money Market Basis Swaps, and Cross-Currency Basis Swaps**, Lehman Brothers, Liquid Markets Research Quarterly, Vol. 2004-Q2.

F. Ametrano and M. Bianchetti, **Bootstrapping the Illiquidity: Multiple Yield Curves Construction For Market Coherent Forward Rates Estimation, in Modeling Interest Rates: Latest Advances for Derivatives Pricing,** edited by F. Mercurio, Risk Books, 2009.

Gary Goldberg, **USD Cleared Swap Curve**, Calypso Technology White Papers, 2016.

Graeme West, **Post-Crisis Yield Curve Bootstrap, Financial Modeling Agency**, March 2010.

J. Clark, Constructing the **OIS Curve**, Edu-Risk International.

M. Johannes, S. Sundaresan, **The Impact of Collateralization on Swap Rates**, Journal of Finance 62, pages 383–410, 2007.

Patrick Hagan and Graeme West, **Methods for Constructing a Yield Curve**, Wilmott Magazine, June 2008.

APPENDIX A:
TECHNICAL DETAILS ON OIS CURVE CONSTRUCTION

The construction of the OIS curve faces the following challenges: i) Short End: The jump behaviour in reference rates around central bank meeting dates is best handled with daily discount factors. ii) It is quite possible that the reference rates may exhibit seasonality due on month-, quarter- or year-end or on dates that involve large structural flows (e.g. tax payment deadline dates). In this case, the short end of the OIS curve should be seasonally adjusted. iii) Long End: these rates can be treated similarly to swap rates, where direct interpolation between quoted OIS rates introduces no significant errors. iv) OIS rates greater than one year pay annual interest. Hence, a traditional bootstrapping approach should be used to back out the OIS curve for OIS rates greater than 1 year. v) Smooth forward rates and splining techniques should be used.

We advocate the methodology proposed by Justin Clark for building the short-dated portion of the OIS curve:

We assume that we have quoted OIS rates for the first number of Meeting Dates (Meeting Dates are M1, M2 etc), let these rates be r_{M1}, r_{M2} etc. Also assume that we have regular tenor OIS rates (r_{T1} and r_{T2}) and times $T1$ and $T2$ – standard tenor dates may be 1-month, 2-month etc.

We also assume that $M2 < T1 < M3$ and $M3 < T2 < M4$.
The basic premise is that in any of the periods between any of the date segments, $M1 \ldots M4$ and $T1..T2$ the Reference Rate is constant.

Assume one can make seasonality adjustments S_t on a daily basis to the quasi static Reference Rate, where the reference rate at time t, $REF_t = REF_{static} + s_t$. It is assumed that the seasonality adjustments, S_t, are known.

Using the seasonality adjusted version of equation (5), we have for the period t_0 to t_{M1} (consisting of d_{M1}) workdays:

$$\frac{r_{M1}(t_{M1}-t_0)}{d_y} = \prod_{i=1}^{d_{M1}} \left(1 + \frac{n_i(REF_i + s_i)}{d_y}\right) - 1$$

Equation (7) relates the interest on the fixed leg (left term) to the interest on the floating leg (right term). The interest on the fixed term is assumed to be simple interest. If we assume that in the period t_0 and t_{M1}, REF_i is considered constant (REF_{M1}) for all i, then equation (7) can be re-expressed as:

$$\frac{r_{M1}(t_{M1}-t_0)}{d_y} = \prod_{i=1}^{d_{M1}} \left(1 + \frac{n_i(REF_{M1} + s_i)}{d_y}\right) - 1$$

Equation 3 can be solved numerically for REF_{M1}.

Once REF_{M1} is known, then the constant reference rate between $M1$ and $M2$ $(REF_{M1,M2})$ can be determined numerically using the following equation:

$$\frac{r_{M2}(t_{M2}-t_0)}{d_y} = \prod_{i=1}^{d_{M1}} \left(1 + \frac{n_i(REF_{M1} + s_i)}{d_y}\right) \prod_{i=d_{M1}}^{d_{M1,M2}} \left(1 + \frac{n_i(REF_{M1,M2} + s_i)}{d_y}\right) - 1$$

Similarly once $REF_{M1,M2}$ has been determined, the reference rate $REF_{M2,T1}$ can be determined thus:

$$\frac{r_{T1}(t_{T1}-t_0)}{d_y} = \prod_{i=1}^{d_{M1}} \left(1 + \frac{n_i(REF_{M1} + s_i)}{d_y}\right) \prod_{i=d_{M1}}^{d_{M1,M2}} \left(1 + \frac{n_i(REF_{M1,M2} + s_i)}{d_y}\right)$$
$$\prod_{i=d_{M2}}^{d_{M2,T1}} \left(1 + \frac{n_i(REF_{M2,T1} + s_i)}{d_y}\right)$$

By the successive application of the same process, one can calculate all the quasi-static reference rates in the short portion of the curve.

In certain markets, forward starting OIS rates are quoted between meeting dates rather than the spot date to the meeting date.
If this is the case, the methodology above can be easily and analogously modified for the forward starting OIS rates between meeting dates.

In order to compute OIS rates for dates other than $M1 - M4$ and $T1 - T2$ dates as described above, we would compound up the daily implied reference rates (including seasonality adjustments) computed over each time segment over the required period. It is important to note that the process of compounding daily implied reference rates are bank meeting dates from OIS quotes instead of using daily implied because of the step function nature of reference rates. Additionally, seasonality will not be able to be applied unless the daily reference rates are used. The shorter the term of the OIS being priced, the greater the possible error could be.

We advocate the methodology proposed by Justin Clark for building the medium-dated portion of the OIS curve:

The approach described above for the short end of the OIS curve should be applied up until the last maturing meeting date OIS. Between the last maturing meeting date OIS and the 1 year OIS, normal interpolation of OIS rates can be used (each currency would have a series of OIS's quoted out to varying maturities).

We advocate the methodology proposed by Justin Clark for building the long-dated portion of the OIS curve:

For OIS's with maturities of greater than 1 year, a bootstrapping approach should be used to generate the OIS curve.

Assume that one has annually quoted OIS rates up to 10 years, one would use the shorter-dated OIS rates first to determine the curve discount factors for shorter maturities and then use these discount factors to aid in the determination of the next longer discount factor.

Assume a set of annual interest paying OIS_i rates quoted for each annual maturity i. Assume that the relevant day count factor (e.g. days/365) for year i is τ_i, then the interest payable on OIS in year j for OIS_i is $OIS_i \tau_j$, provided $j \leq i$, the interest is = 0 otherwise.

Assuming that the OIS trades at par, then the following equation holds for all i:

$$100 = \sum_{k=1}^{i} OIS_i \tau_k f_{0,k} + 100 f_{0,i}$$

where:

$f_{0\ k}$ = discount factor from time t_0 to time t_k

It can be seen that from starting in year 1 and using OIS_1, one can easily calculate $f_{0,1}$. Once $f_{0,1}$ has been calculated, then $f_{0,2}$ can be calculated from OIS_2 and $f_{0,1}$.

Improve System Performance and Profitability

> Finastra Services can help you to improve the pricing quality of your front office system and ensure alignment with market best practice.

Fusion Kondor is the ultimate system for markets trading. With Curves Checking, we can help you improve your pricing valuation capabilities, leading to enhanced performance and improving pricing quality.

Maintaining Fusion Kondor's system performance at optimal level benefits the entire organization from the front office to the back office, and helps you achieve better pricing, which could result in better maintained capital reserves, and cash payments related to collateral agreements.

If your Yield and Volatility curves are not properly configured, this can cause discrepancies in asset pricing and the profit and loss calculations. Our experts can help you optimize the Fusion Kondor configuration to ensure you are aligned with market best practice, improving pricing and risk management across all instruments.

Approach

In a three-stage process, our expert consultants analyze your curve structure to determine instrument valuation and adherence to market best practice. This reveals whether curves need to be updated, replaced or deleted.

1. **Review Stage**

   We analyze the system in terms of structure, instrument definition, assignment and overall usage to determine what improvements could be made

2. **Business investigation**

   We discuss potential pricing issues with different business departments

3. **Detailed analysis**

   Our report outlines possible problems and suggests options to improve pricing accuracy and adherence to market best practices.

Once the three-stage process is completed we will provide you with a document detailing the client environment analysis and suggested actions. You can choose to follow the suggestions independently, or we will be happy to support any changes necessary.

Finastra Services can unlock the potential of our software, leveraging best practice to reduce costs and improve client profitability.

About Finastra Services

Finastra Services comprise specialized teams across consulting, delivery, training and support. Together, they enable Finastra to consistently deliver great customer outcomes with our solutions.

Leveraging our people, ecosystem and a wide range of enablement tools and approaches, Finastra Services help you to optimize the time to market, user experience and return on your investment in Fusion solutions, making them better, faster and safer.

To find how to improve your system performance, contact your Finastra Services representative now and benefit from a customized service at a fixed price.

Benefits

- Improved portfolio evaluation
- The ability to adapt to market changes such as level of liquidity or economic events
- Opportunities to trade new offshore currencies
- Avoidance of pricing discrepancies
- Compliance with regulatory requirements
- Improved Kondor performance speeds:
  - Reduce Kondor Curves Server (KCS) loads
  - Speed up batch process

The Finastra services team has several years' experience of effectively managing curves in Kondor.

We can help you find an effective solution for your potential pricing issues or help identify any problem with amendment of curves.

To see how we can help you, contact us today at services@finastra.com

---

About the author

Pedro Porfirio
Global Head of Treasury & Capital Markets, Finastra

Pedro Porfirio leads the global field and customer engagement with capital markets customers and prospects. Based in London, Pedro drives the growth of the company's entire capital markets business line spanning treasury, capital markets, and investment management. Pedro joined Finastra from Calypso Technology where he worked as Chief Product Officer, and brings over 25 years' experience in banking and technology. Pedro holds an aerospace engineering degree from ITA in Brazil and an MBA from University of Michigan.

Contact: **Pedro.Porfirio@finastra.com**

About Finastra

Finastra is building an open platform that accelerates collaboration and innovation in financial services, creating better experiences for people, businesses and communities. Supported by the broadest and deepest portfolio of financial services software, Finastra delivers this vitally important technology to financial institutions of all sizes across the globe, including 90 of the world's top100 banks. Our open architecture approach brings together a number of partners and innovators. Together we are leading the way in which applications are written, deployed and consumed in financial services to evolve with the changing needs of customers. Learn more at **finastra.com**

Corporate Headquarters
4 Kingdom Street
Paddington
London W2 6BD
United Kingdom
T: +44 20 3320 5000