

Pricing: Staying ahead of the game as hard to value securities become evermore mainstream

Leading the way with Complex Pricing – Hugh Hanna, Global Head of GDS

Checking the Model, Refining the Data – Roger Boyd, Global Head Complex Pricing

OTC Middle Office Services: Asset Management Solutions – Jackie James, Head of OTC Derivative Services EMEA

Spotlight on Independent OTC Derivatives Valuation

The valuation of complex Over-The-Counter (OTC) derivatives has been under the spotlight in the past year.

- Commentators have noted that the practice of marking-to-market had sometimes actually been replaced by 'marking-to-myth'
- There is increasing wariness of an over-reliance on pricing that relies solely on counterparties. For hedge funds keen to retain the confidence of investors, it has never been more important to be able to demonstrate
- Transparency of the valuation of Over-The-Counter instruments
- Citi has long led the way in the provision of independent valuations for OTC derivatives and hard-to-price securities. Set up in 2003, as a response to the growing number of client traded credit derivatives, Complex Pricing offers a competitive advantage in the Fund Accounting space

Founding a Global Complex Pricing Utility

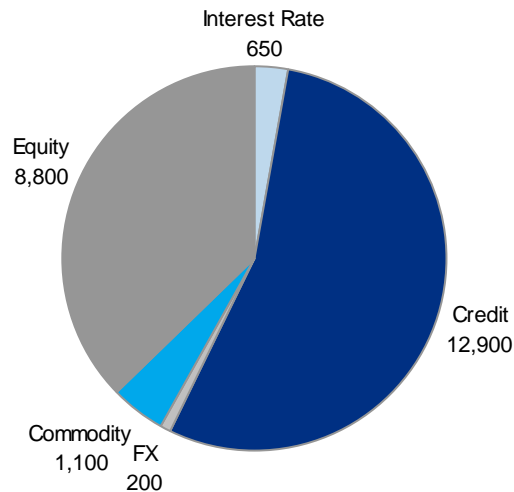
Talking to the client in his own language.

- Made up of dedicated analysts with finance, economics and mathematical backgrounds, the team has the ability to reverse-engineer OTC derivatives by drilling down into the underlying structure and in so doing question or validate its pricing
- Located in Dublin, the CPG acts as a centralised, global utility. It has responsibility for pricing the more complex funds and deals with more than 20,000 OTC positions. Valuations are provided on a monthly, weekly or daily basis
- Those prices are then compared with secondary pricing sources, such as those from an Investment Manager. Where differences exceed pre-determined tolerance levels, an analyst reviews the underlying market data and valuation model to determine the root of any price challenge
- This service sets apart Citi from other administrators. In the instance of a price challenge, the skills set of a derivatives specialist is essential to perform a deep-dive analysis and give an objective and informed view
- There are certain complex derivatives, such as correlation swaps or equity variance swaps, where the Group has access to more data than the client
- With access to a full range of forward curves, volatility surfaces and currency pairs, the Team can independently value a position or reverse-engineer a valuation, decomposing an instrument into its constituent parts

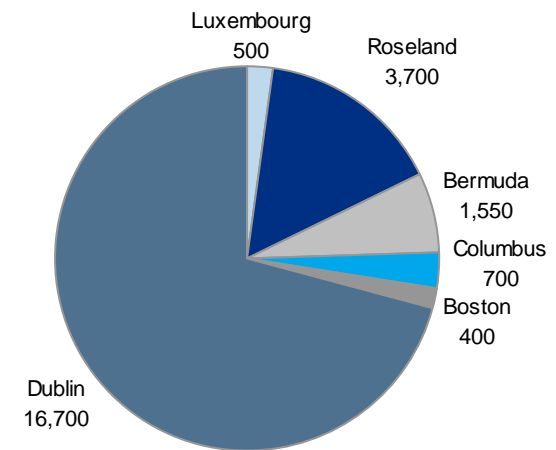
OTC Derivative Valuation Services Overview

- Dedicated Complex Pricing Team, located in Dublin
- Independent valuation of OTC Derivatives and Hard-to-Price securities
- Team is divided into two segments
 - A & R: Proactive non-operational market analysis and model research
 - Operations: Valuation and reverse-engineering of structures
- Highly technical specialist unit with economic and statistic competencies
- Client base holding more than 23,000 OTC Derivative positions

OTC Derivatives by Asset Class



OTC Derivatives Volumes by Service Center



Excludes FX Forwards

OTC Derivative Valuation Services

Citi offers the administration experience and expertise to secure independent valuations. Long-standing relationships with a range of providers allow us to be flexible with the most complex derivative products.

Benefits at a Glance

- Transparency in an ever-more-demanding environment
- Access to a portfolio of best-in-breed valuation providers covering complex derivative products
- Streamlined processing helps minimise back and middle-office investments
- Assurance that valuations are fully independent
- Ability to leverage broad client base to obtain most efficient and high-quality valuations for clients
- Audit capabilities available to verify that all trades are confirmed and reconciled

Complex Pricing Team Key Capabilities

Analysis and Research

- PhD/Mathematics Graduates
- Proactive: Non Operational
- Direct Liaison with Investment Managers
- New Model Assessment
- Traded Instrument Analysis
- Market Developments

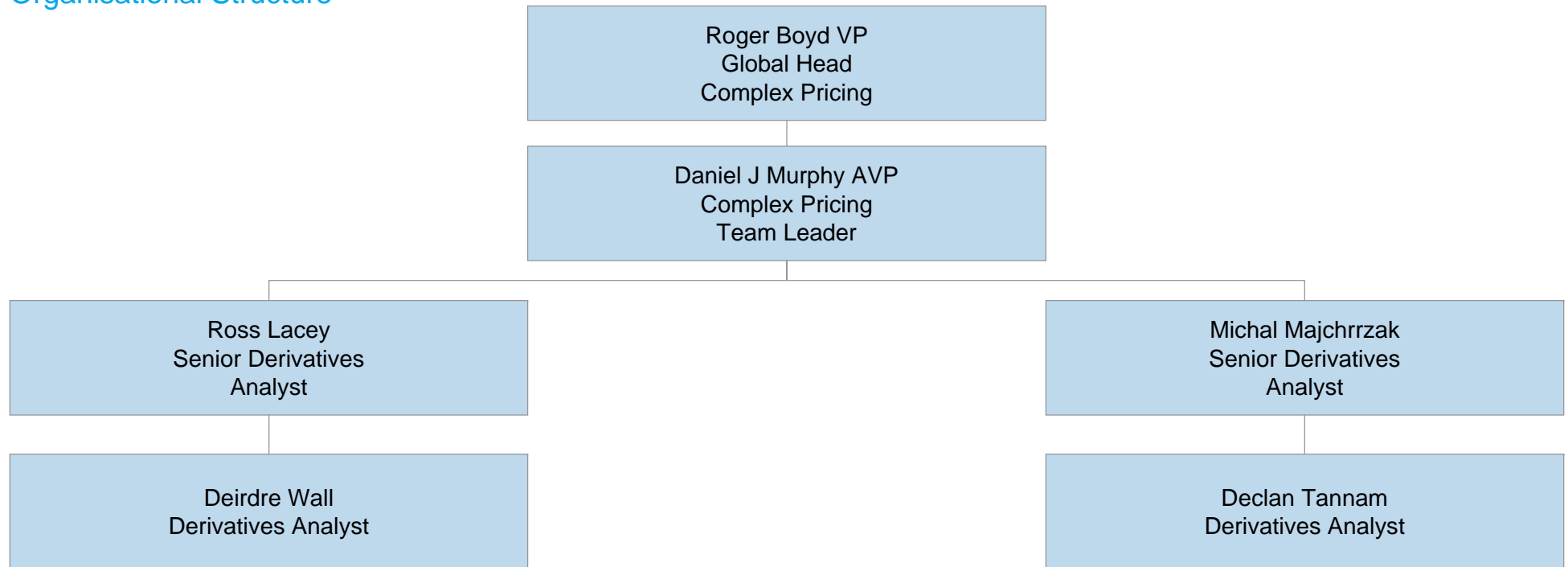
Operations

- Experienced Financial Engineers
- Mathematics/Statistics Graduates
- Independent Pricing
- DV01 Based Tolerance Report
- Reverse-engineering
- Liaison with Fund Accounting

Complex Pricing Team Structure

Complex Pricing

Organisational Structure



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Checking the Model, Refining the Data

The Complex Pricing Group checks both the integrity of the data used by valuation providers and the acceptability of the models used by such companies chosen to provide independent valuation.

- In one case, the team questioned the recovery rate assumptions used by a fund client for a particular credit default swap (CDS)
- A market default recovery rate of 40% was being used as standard, but this element of a CDS valuation is dynamic and pricing should reflect market conditions
- An exploratory conversation with the client resulted in them accepting the rationale behind Complex Pricing's findings and a subsequent change to the valuation process
- Another example, of where Citi's CPG has proved of considerable benefit was when we were able to demonstrate to a valuation vendor that its approach to pricing a long-dated equity variance swap, essentially a bet on market volatility, could be improved
- One of our largest investment management clients had taken out a 10-year equity variance swap and the instrument was proving very difficult to value due to the absence of pertinent market data
- In this instance, the vendor was providing daily quotes off the back of monthly observations of volatility. Following a discussion with the vendor and the client it was agreed that such observations would not be acceptable
- Complex Pricings role in this instance was to independently reverse-engineer the vendor price and to display to valuation agent and client alike the root of the price challenge
- This resulted in the vendor agreeing to make more frequent volatility observations, this resulting in more accurate valuation

OTC Derivative Valuation Services – Product Coverage

Interest Rate Products

- Vanilla swaps (LIBOR / CMS)
- Amortising, structured and basis swaps
- Forward rate
- Swaptions
- Interest rate exotic options

Equities

- Equity swaps
- Equity options
- OTC warrants
- Dividend swaps
- Exotic equity options

Credit Products

- Single name credit default swaps
- Index credit default swaps
- CDS options
- Tranche CDS
- Synthetic CDOs
- Credit linked notes
- First to default swaps
- Recovery swaps
- Asset backed CDS
- ABX, CMBX and TABX Indices
- Bank debt
- Single name loan CDS
- Index loan CDS

Foreign Exchange

- FX forwards
- Vanilla and exotic FX options

Volatility

- FX, equity and index variance and volatility swaps

Commodities

- Commodity swaps and options

Additional Products

- Total rate of return swaps
- Inflation swaps
- Ascots
- Tender option bonds
- Freight derivatives

Conclusion

Added Value

- Relationship Building
- Proactive Specialist Client Liaison
- Market/Instrument Awareness

Dynamic

- Increasing Automation
- Global Valuation Review
- Vendor Management

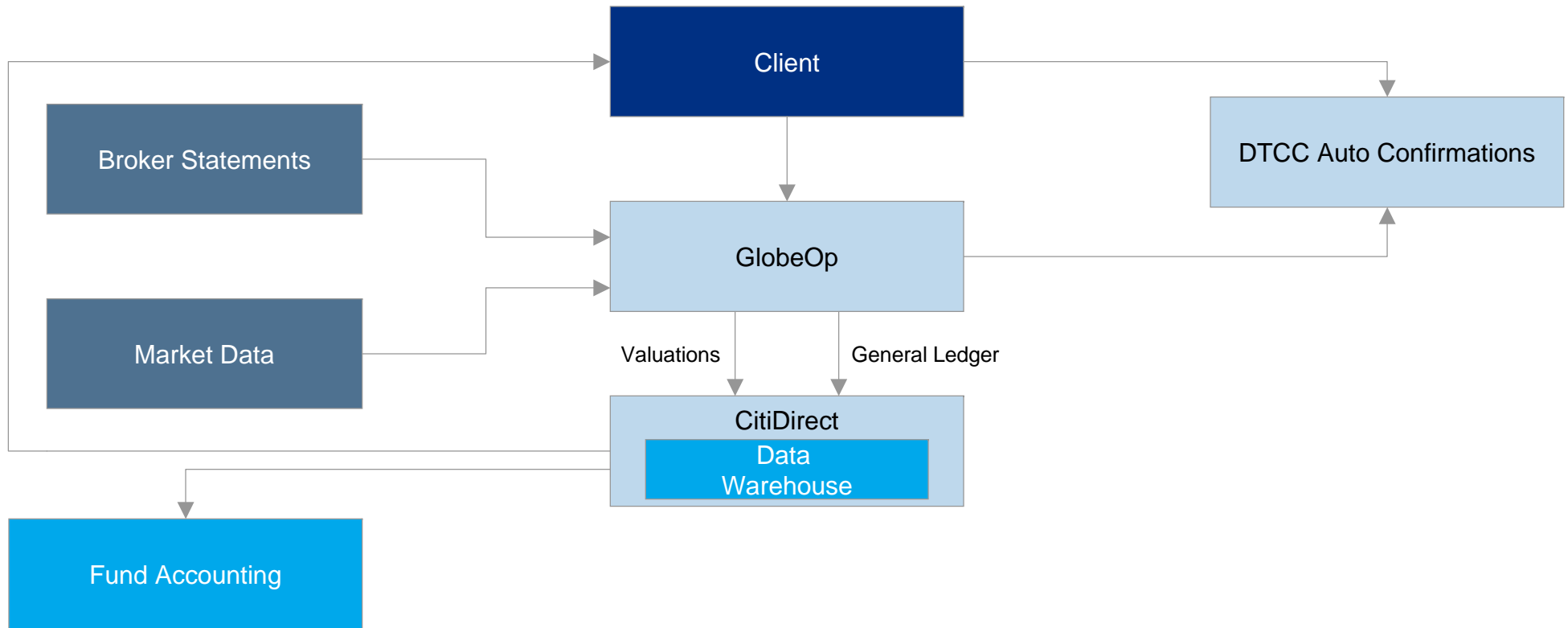
OTC Derivatives – Middle Office Services

- Citi has established a global partnership with GlobeOp Financial Services, an international expert in the OTC derivatives field and can jointly offer a full OTC service for pricing, management and accounting of OTC derivative instruments
- A robust and scalable service, Citi has established an efficient and reliable alternative to cumbersome and unwieldy spreadsheets
- Citi can deliver timely, reliable and accurate valuations on T and T+1
- Automated confirmations and life cycle management
- Initial Models and Valuation methods agreed with each client for each instrument type
 - Including curves
 - Data sources
 - Interpolations
 - Day counts etc.

Valuations of OTC Derivatives

- Daily pricing of each position by independent pricing model
- Daily Tolerance checks will be performed within agreed parameters on all valuations
- Parameters can include
 - Day on day cash movements – % and US\$ amount
 - Day on day – DV01's, IDV01's, Credit DV01
 - Greeks
- Automated Exceptions Report for further pricing analysis where required – linked to the Citi Dublin Team
- Full Suite of Risk Data and Investment Data

OTC Derivatives – Operating Model



- Trades captured via automated link or desktop
- Trades are auto confirmed within DTCC
- After processing, GlobeOp daily upload trade details, valuations and accounting entries to Citi Data Warehouse
- DWH uploads valuation and accounting entries for OTC derivatives transactions for NAV accounting

Data Warehouse for OTC's

- There is full automation between GlobeOp and the Citi Data Warehouse (DWH)
 - Data is collected daily via a secure link and automatically loaded
- The DWH contains all recorded trade information, general ledger accounting information, underlying cash flows and risk data
- The MultiFonds OTC accounting data is held as pending. On completion of all appropriate checks, the official daily NAVs are released. This is an automated process
- Accounting entries are updated daily
- The data is translated into the appropriate format for feeding MultiFonds; which is driven by how the instruments are booked or represented in MultiFonds

Trade Processing – Trade Capture

Before Trading

- Agree Models for each instrument type
- Agree Procedures and input fields required
- Agree Tolerance levels for each instrument

Trade Capture

- Fund Manager inputs trades into OTC trading System
- Direct into Third Party System
- Auto Uploaded to GlobeOp

Trade Capture

- Monitor Trade automated upload process
- Review and resolve unsuccessful trade uploads
- Provide any assistance required for trade entry

Final Stage

- Client receives confirmation trade received successfully
- Fund Manager has completed their task

Trade Processing

Trade Confirmations

- Receive trade confirmation and chase all delays
- Verify and agree against trade details
- Automated system – client can track their trade progress

Documentation

- Confirms auto checked against core economic terms
- DTCC enhance and automate process
- Non DTCC trades -processed through to fund managers for sign off

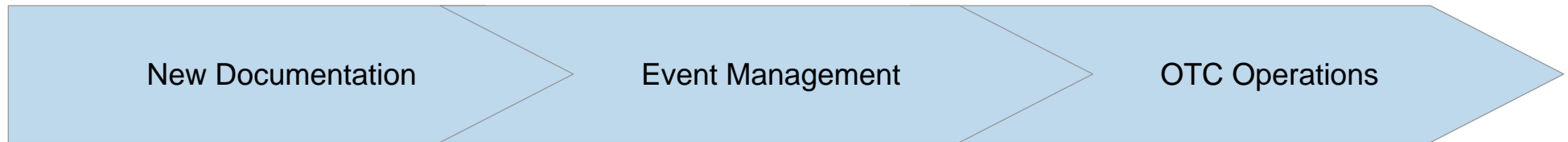
Processing

- Trades received up to 4pm daily will be included
- Trades received after 4pm included next day
- Trade details confirmed and agreed – automated report produced

Payment

- Trade and payment details checked and agreed
- Automated Payment Processed through Citi Swift subject to checking
- Daily settlements report checked and verified
- Client can view all of this process through the automated system

Non-trade Processes



- New instrument models verified and agreed by fund managers
- All new processes through Citi change control
- Counterparty details documented prior to trade
- Documentation fields and core economics to be agreed and clearly documented

- Processed through the trade capture system
- Partials, closes etc are linked within the trade capture system
- Event notification Client inputs direct into trade capture system
- Life Cycle Events
- Flow automated through system, same as a new trade

- Option expiry and LIBOR reset reports
- Monitor/assist with exercise of options
- Immediate automated trade notification to administrator/custodian
- Process and notify payments and receipts
- Process and notify LIBOR, coupons, CDS
- Reconciliation and resolution with broker statements

Other Non-trade Processes

- Reconciliation and resolution with administrator for all items including cash
- Cash Flow movements notified to custodian and administrator
- Investigate trade breaks
- Pricing Information loaded into Valuation system
- Position Reconciliation with Counterparty
- Accounting Entries uploaded daily to custodian for updating fund accounting entries and NAV's
- Daily trade File values all collateral positions
- Automated collateral file sent to custodian and client
- Collateral Calls and wires processed and notified to client
- Client can view collateral file real time
- Client has direct access to reports and can download when required
- Reports cover periodic reporting, NAV's

Conclusions

- Reduce headcount associated with highly manual OTC tasks
- Increase efficiency and reduce risk
- Reduce risk associated with highly manual OTC tasks and manual valuations
- Remove continual investment required in OTC Technology to stay ahead
- Direct relationship remains with Citi
- Process and pricing remain transparent to client at all times
- Controls remain transparent at all times and Citi has strict oversight of GlobeOp

Questions

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In January 2007, Citi released a Climate Change Position Statement, the first US financial institution to do so. As a sustainability leader in the financial sector, Citi has taken concrete steps to address this important issue of climate change by: (a) targeting \$50 billion over 10 years to address global climate change: includes significant increases in investment and financing of alternative energy, clean technology, and other carbon-emission reduction activities; (b) committing to reduce GHG emissions of all Citi owned and leased properties around the world by 10% by 2011; (c) purchasing more than 52,000 MWh of green (carbon neutral) power for our operations in 2006; (d) creating Sustainable Development Investments (SDI) that makes private equity investments in renewable energy and clean technologies; (e) providing lending and investing services to clients for renewable energy development and projects; (f) producing equity research related to climate issues that helps to inform investors on risks and opportunities associated with the issue; and (g) engaging with a broad range of stakeholders on the issue of climate change to help advance understanding and solutions.

Citi works with its clients in greenhouse gas intensive industries to evaluate emerging risks from climate change and, where appropriate, to mitigate those risks.

efficiency, renewable energy & mitigation

