Cleared OTC Financial Products

Security. Neutrality. Transparency.

CLEARING THE WAY FORWARD

CME Group

Contents

Interest Rate Swap Clearing

Why Customers are Choosing CME Group for OTC

- **Over 650 customers have chosen and used CME Group for their OTC clearing business**
- **More than 25 liquidity providers that are both US and Non-US institutions**

Broadest Product Offering

- Global **multi-asset class solution** for IRS, FX, and Commodities
- Only clearing house to offer clearing in **24 IRS currencies including Chilean Peso and Colombian Peso, and Chinese Yuan**

Margin Efficiencies

- Capital efficiency of **portfolio margining** of IRS and swaptions vs. Interest Rate Futures, including Eurodollars, Treasuries, Mac Swap Futures, and Ultra Bond
  - **15 Clearing Members** now live and over 700 accounts taking advantage of this solution, with risk reductions now generating an average **$2.4 billion in margin efficiencies in 2018**

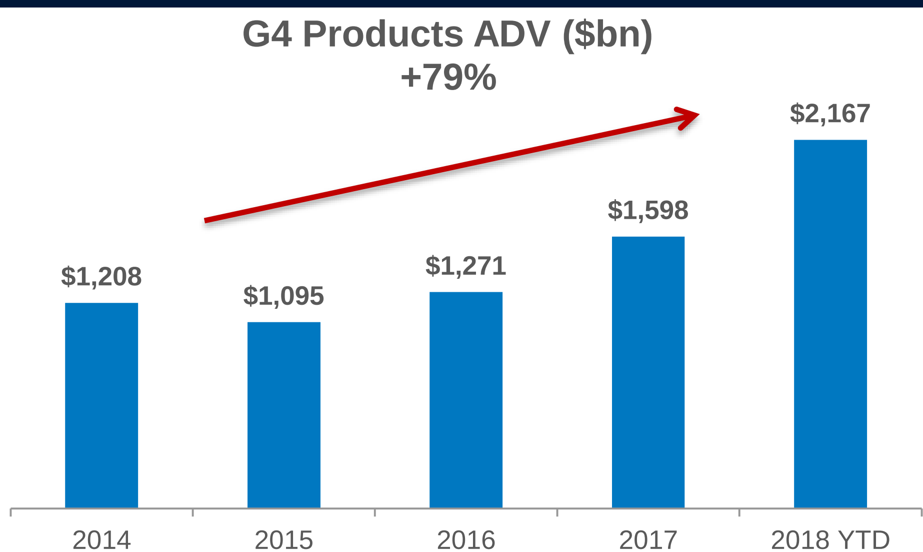
Operational Flexibility

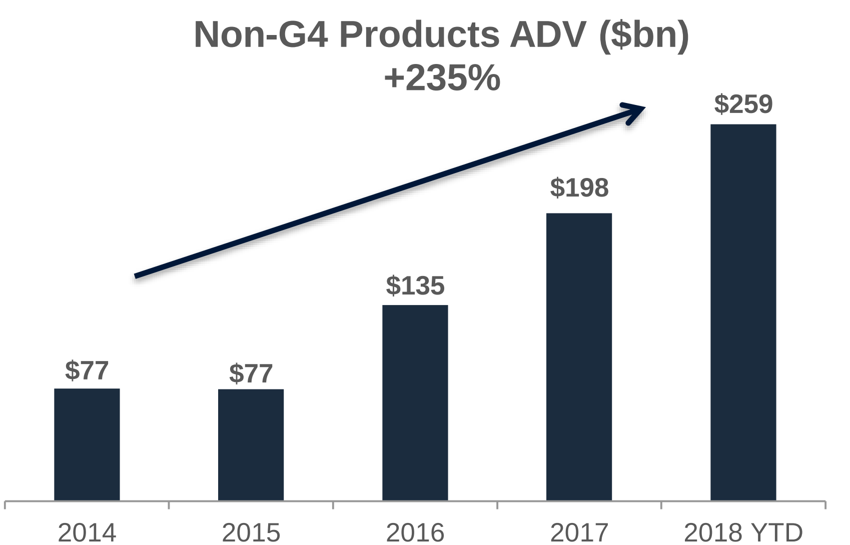
- Ability to **real-time clear trades** in **all time zones** with global follow-the-sun customer support
- **Compression via coupon blending** that reduces gross notional outstanding and line items

OTC Highlights & Trends

- **Voluntary Clearing:** Clearing of non-mandated products continues to be the primary focus for clients in the OTC space, as the impacts of uncleared margin rules spreads through the market.
- **Growing Our Core Offering:** CME has cleared over $114B average daily notional across currencies and products in 2018 to date, representing +8% versus 2017 ADV, with over 650 participants clearing across all currencies.
- **Broadening LatAm Presence:** MXN, BRL, and newly-launched CLP and COP Swap offering has seen over 200 participants, including over 30 regionally-based participants, clearing a $27bn ADV in Q3-2018.
- **Delivering Capital Efficiencies:** Over $46T and 1m line items reduced to date via triReduce and Coupon Blending solutions. Our compression services are utilized by both members and non-members, growing the realized efficiencies.
- **Product Innovation:** Launched SOFR Swap Clearing on October 1st along with CLP, COP and CNY IRS clearing on May 21st , which have cleared over $171bn to date. Continuing to scale our USD Swaptions and OTC FX clearing.

Across the IRS Clearing Industry, Voluntarily Cleared Products are Growing 3X Faster than Mandated Products*





**Sources: Reported clearing volumes by Global CCPs*

Latin America IRS Clearing

Leading Liquidity Pool

- $31bn ADV in LatAm IRS clearing 2018, up 39% from 2017
- 40 Liquidity Providers and 13 FCMs providing Client Clearing
- Record $19.4 billion MXN ADV in September, and over 200 unique participants to date
- $11 billion ADV in BRL, 48% increase from 2017
- Launched Chilean and Colombian Peso on May 21st
- 49 participants clearing over $2.2bn ADV in CLP and COP

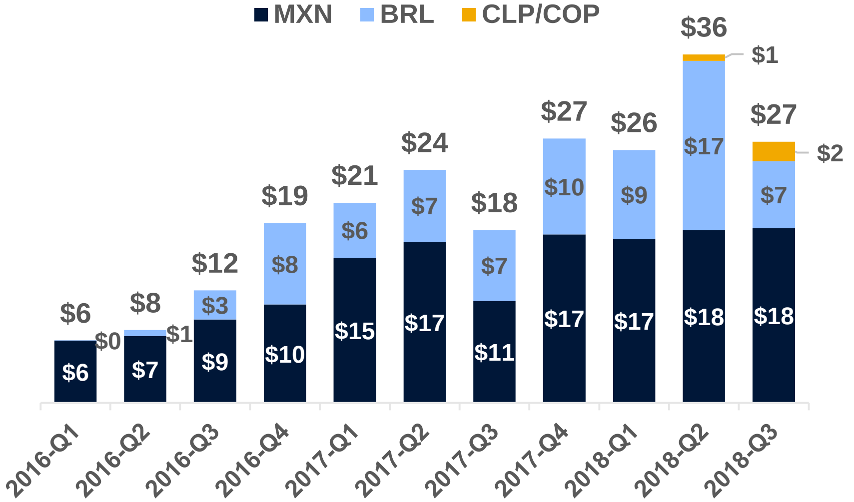
Regional Focus

- 34 regional participants clearing through CME's offering
- >95% of MXN and 85% of the Offshore BRL Swap market
- Leading regional banks and brokerages providing liquidity
- Only Global CCP accepting MXN Sovereign debt for initial margin
- MXN Tenors supported out to 31 years beginning October 22nd

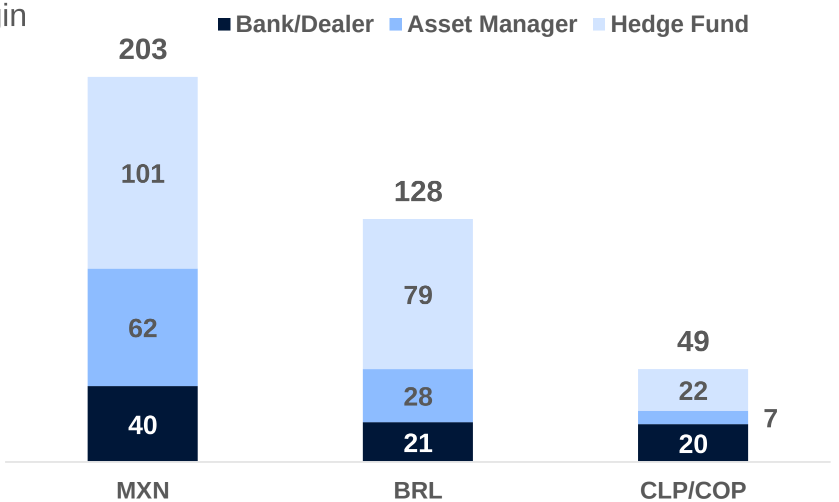
Unmatched Capital and Margin Efficiencies

- $4T compressed by triReduce and Blending in MXN and BRL
- 10 triReduce cycles in LatAm and 4 non-members participating
- Portfolio margining with CME Group's leading Interest Rate Futures complex and our 24 cleared OTC currencies
- Counterparty netting enabling efficient use of balance sheet

Avg. Daily Notional Volume



Participant Ecosystem



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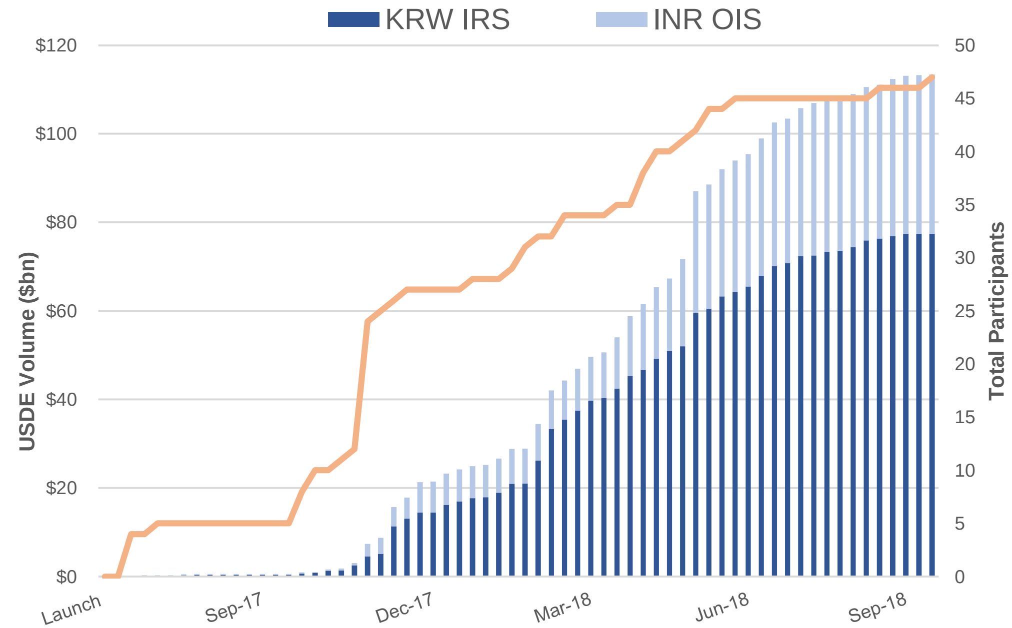
*Based on reported trade count from Clarus SDRview

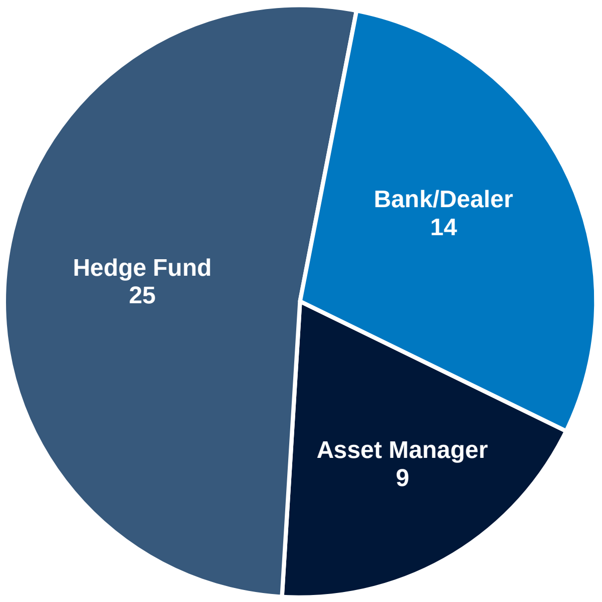
APAC IRS Clearing

- CME launched clearing for KRW IRS and INR OIS in July 2017 and CNY on May 21st, 2018 to further extend our industry-leading offering to 24 currencies.
- CME has cleared over $118 billion in notional to date with $97 billion of that being done in 2018, as clients have continued backloading their bilateral exposures into clearing.
- 48 participants have cleared the currencies and 15 liquidity providers are live
- Over $41 billion notional outstanding in KRW, and $17 billion in INR. We expect this to continue growing as more participants continue to clear new and existing bilateral positions.

APAC Total Volume and Participants



APAC Participant Ecosystem



Products Supported – OTC IRS

Fixed/Float Currency	Tenor Years						Index Months			
	10	11	15	21	31	51	1	3	6	
USD							✔	✔	✔	LIBOR
EUR							✔	✔	✔	EURIBOR
GBP							✔	✔	✔	LIBOR
CAD								✔		CDOR
JPY							✔	✔	✔	LIBOR
CHF									✔	LIBOR
AUD								✔	✔	BBR
SEK								✔		STIBOR
DKK									✔	CIBOR
NOK									✔	NIBOR
MXN							28d			TIIE-BANXICO
KRW								✔		KRW-CD-KSDA- BBG
CLP										CLP-TNA (Indice Cámara Promedio)
NZD								✔		BBR
HKD								✔		HIBOR
SGD									✔	SOR-VWAP
HUF									✔	BUBOR
CZK									✔	PRIBOR
PLN									✔	WIBOR
ZAR								✔		JIBAR
CNY										CNY-CNREPOFIX=CFXS-Reuters

Zero Coupon Swaps	
USD | EUR | GBP	50 years
BRL	10 years
Overnight Index Swap (OIS)	
USD | EUR | GBP | JPY	30 years
SOFR	30 years
COP	20 years
INR	10 year
AUD	6 years
CAD	3 Years
Basis Swaps	
USD | EUR | GBP	51 years
AUD | JPY	31 years
Fed Funds vs. Libor (USD)	30 years
SOFR vs. Fed Funds	
SOFR vs. Libor	
Forward Rate Agreements (FRA)	
USD | EUR | GBP | JPY | AUD | CAD	3 Days – 3 Years
CHF | CZK | DKK | HUF | JPY | NOK	
NZD | PLN | SEK | SGD | ZAR	
Swaptions	
USD (≤ 2 years expiry)	30 years

http://www.cmegroup.com/trading/interest-rates/cleared-otc/

CME Group Swaptions Clearing

Clearing Swaptions Exposures Amplifies our Unparalleled Capital Efficiencies

CME has cleared over $750m notional volume in since September 2017

- ✓ 9 participants have cleared swaptions to date, including 4 buy-side customers and 5 liquidity providers
- ✓ Voluntary clearing allows market participants the flexibility to reduce the risk of their cleared IRS portfolios
- ✓ Margin offsets of up to 91% possible by adding swaptions to CME cleared IRS portfolios
- ✓ Portfolio margining with our cleared IRS and Eurodollar, Treasury, and Deliverable Swap Futures
- ✓ Reduces bilateral counterparty credit risk and frees up credit lines
- ✓ Improves capital ratios, lowering capital charges that could ultimately be passed onto end users

"With uncleared margin rules coming into greater focus for our clients, Credit Suisse is excited to facilitate voluntary swaptions clearing at CME Group. Clearing swaptions enables our clients to obtain the greatest operational and capital efficiencies from clearing, while reducing the risks in their portfolios."

John Dabbs, Global Head of Prime Derivatives Services at Credit Suisse

"Barclays is proud to collaborate with CME Group as one of the banks to execute the first cleared swaption trade. Clearing through CME will allow both Barclays as well as our clients to significantly improve the capital consumption and risk management of our swaptions portfolios."

Sabri El Jailani, Global Head of Rates Options Trading at Barclays

*Pending regulatory approval

Cleared OTC IRS Swaptions Product Scope

Current Product Offering

		Max Expiry			Final Settlement	Underlying Tenor		Index			
Currency	Type	Years			Method	Years (up to)		Months			
		≤ 2	≤ 5	≥ 10	Physical	30	50	1	3	6	
USD	European										LIBOR

- USD vanilla swaptions
- Includes Straddles, cleared as a single trade or separate payer/receiver
- All enumerations for USD-denominated 3 month LIBOR vanilla interest rate swaps supported, with the exception of:
  - Compounding
  - Forward starting swaps
  - Spreads and stubs

OTC FX Clearing

Global FX Clearing Solution

The broadest and most capital efficient FX clearing solution to meet your needs

- **Single guaranty fund:** a diverse pool of products across asset classes amounting to a >$4.5 billion Base Guaranty Fund. The result is a secure and cost effective solution which is an 1/8th of the cost on incremental funding compared to other FX clearing providers.
- **Unparalleled portfolio margining** opportunities between cleared FX and exchange listed FX Futures and Options, with NDF margin reductions of up to 84% against emerging market futures and 39% against G10 futures*. The regulatory authorization for enabling portfolio margining between ETD FX and OTC FX products is in place.
- **The first and only NDF Coupon Blending solution**, significantly reduces notional outstanding and line items.
- **The only cleared cash-settled FX Options solution**, which provides superior cost and capital efficiencies to physically delivered options solutions.

* Analysis for IM savings conducted on January 11 2018

NDF & G10 NDF Offering

The CME OTC FX offering includes 11 NDF contracts and 26 Cash Settled Forwards ("G10 NDFs")

OTC FX Cash-Settled Forwards	OTC FX Cash-Settled Forwards	OTC FX Non-Deliverable Forwards
EUR/USD	USD/PLN	USD/BRL
AUD-USD	USD/ZAR	USD/PHP
GBP/USD	USD/CZK	USD/IDR
USD/CHF	USD/TRY	USD/KRW
USD/SEK	USD/THB	USD/CNY
USD/DKK	USD/CAD*	USD/INR
NZD/USD	USD/JPY*	USD/TWD
USD/NOK	AUD/JPY*	USD/CLP
USD/HKD	EUR/JPY*	USD/COP
USD/HUF	CAD/JPY*	USD/PEN
USD/ILS	EUR/AUD*	USD/RUB
USD/MXN	EUR/CHF*	
USD/SGD	EUR/GBP*	

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* Non USD Settled

FX Options Product Overview

Product Overview

- FX Options went live for clearing on November 27, 2017
- Cash settled plain vanilla European style FX Options
- USD/JPY, EUR/USD, GBP/USD, AUD/USD, USD/CHF, USD/CAD, EUR/GBP
- 10am NY auto exercise – cash settlement (with settlement in quote currency)
- Options out to 2 years including any strikes
- Fixing Rate is WM/R 10am NY

Highlights

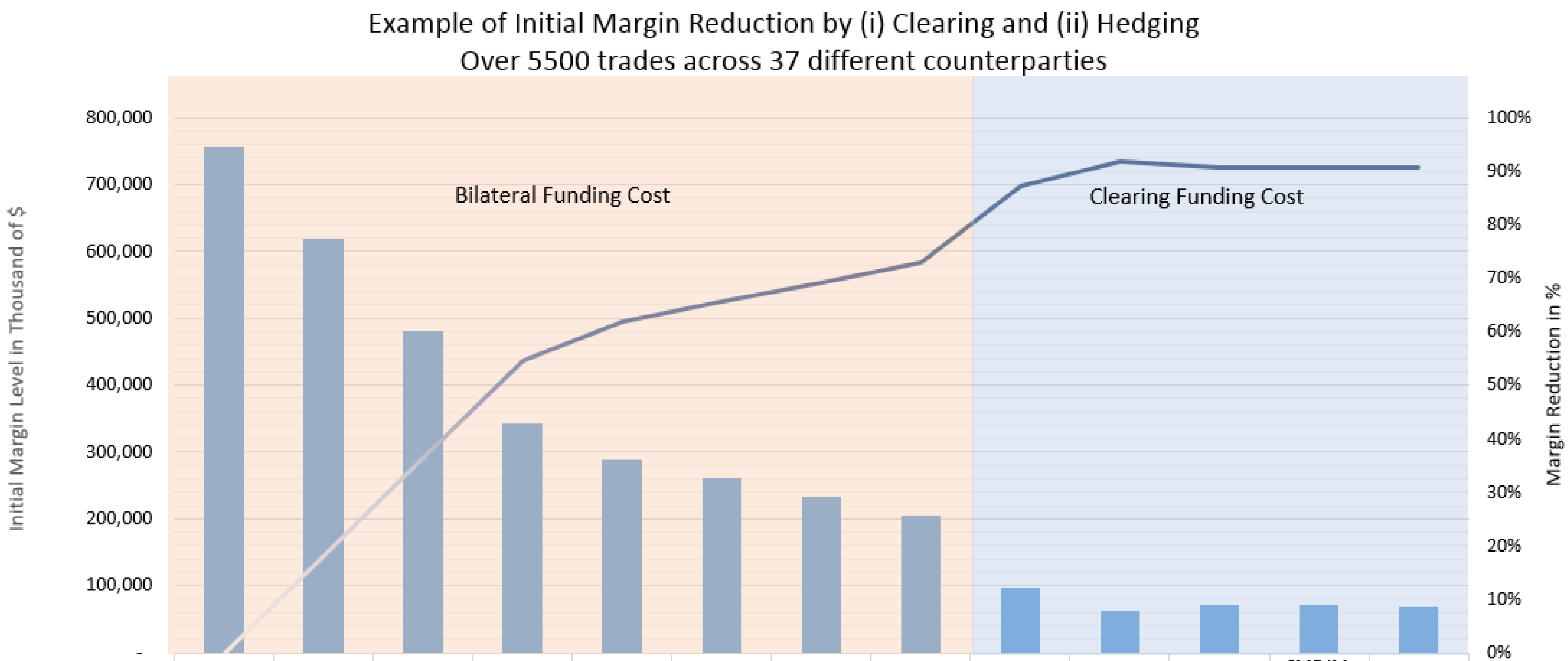
- CME has cleared 100 NDF trades and $1.5bn in notional since September 27th
- To date, 6 liquidity providers and 3 FCMs have cleared at CME
- Completed the first Quantile optimization cycle in October for a record $1.3bn in notional volume
- CME is the first and only CCP to offer NDF coupon blending

Managing Cleared Delta to Optimize Cleared Initial Margin

- CME offers the cleared products below to manage the delta of cleared FX Options. These products will be portfolio margined together to help optimise the cleared IM requirements:
  - 26 cash settled forwards (“G10 NDFs”)
  - ~100 Listed FX Futures (quarterly and monthly expiries)
  - CME FX Link (CLOB Traded OTC Spot Vs CME FX Futures basis) launches Q1 2018

FX Options – Demand Driven by IM Efficiencies

The CME FX Options solution delivers material IM efficiencies versus the ISDA SIMM requirements on bilateral activity



	SIMM of original portfolio	SIMM w. reduce delta by 25%	SIMM w. reduce delta by 50%	SIMM w. reduce delta by 75%	SIMM w. reduce delta by 80%	SIMM w. reduce delta by 90%	SIMM w. reduce delta by 95%	SIMM w. reduce delta by 100%	CME IM of original portfolio	CME IM CSF hedged at std. tenor	CME IM 1M CSF hedged	CME IM 1M synthetic fwd hedged	CME IM Q1 futures hedged
Initial Margin (K)	757,626	619,556	481,486	343,415	288,187	260,573	232,959	205,345	96,274	61,491	70,386	70,389	69,452
Offset	-	18%	36%	55%	62%	66%	69%	73%	87%	92%	91%	91%	91%

Portfolio Margin Solution for FX

Portfolio Margin

- CME has offered portfolio margining services for ETD versus OTC products since 2012
- The existing offering for IRS is supported by 15 FCMs and used by >700 client accounts every day to generate savings of $2.4bn
- The regulatory authorization for enabling portfolio margining between ETD FX and OTC FX products is in place
- This authorization applies to all ETD and OTC FX products currently live at CME and also covers product extensions such as NDOs when they are made available for clearing
- CME can conduct analysis to show the benefits of portfolio margining ETD FX versus OTC FX now, and the functionality to offer the service in production is under development for release later in 2018
- The table below shows some examples of potential savings available via the CME portfolio margining solution.*

Contracts Included in Portfolio Margining	Initial Margin Off-Set
Non-Deliverable Futures Versus OTC NDFs	84%
Non-Deliverable Futures vs G10 OTC NDFs	39%
G10 Futures Versus G10 OTC NDFs	93%
G10 Futures Versus OTC NDFs	41%
G10 Futures Versus G10 OTX FX Options	28%

* Figures in table from analysis conducted on January 11 2018

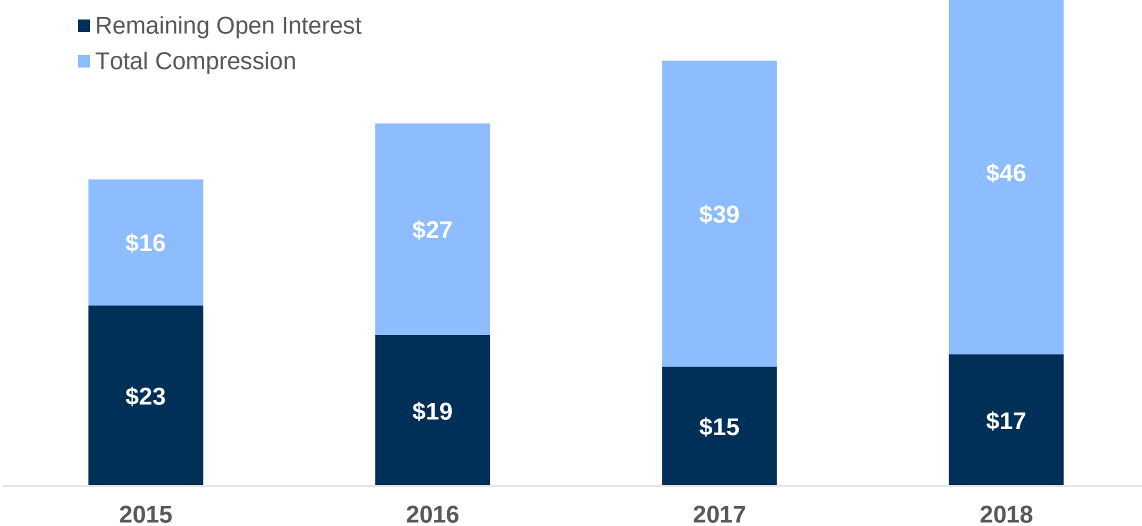
Capital & Margin Efficiencies

Interest Rate Swap Compression at CME Group

- **Creating Capital Efficiencies for Participants:** Over 1 million line items and $46 trillion in notional reduced to date, and helping decrease open interest by over 30%.
- **Client Compression:** CME conducted our first multilateral non-member compression cycle in 2017, and now have 6 non-members have participated in triReduce cycles along with 19 non-members utilizing coupon blending.
- **Blending Enhancement:** Launched configurable fixed rate blending this year, further growing compression efficiency

Interest Rate Swap Compression at CME Group

Cumulative Trillions USD Equivalent



TriOptima
$22 Trillion & 686k Lines

+ Coupon Blending
$24 Trillion & 330k Lines

= Total Reduction
$46 Trillion & 1M Lines

TriOptima Compression Cycles						
Notional Reduced	$16.6T	$2.5T	$1.8T	$550B	$291B	$118B
Lines Items Reduced	372k	191k	77k	25k	14k	7k
Number of Cycles	15	7	6	3	1	1

Initial Margin Models

Summary of the CME Initial Margin Model for IRS

- 99% 5-day coverage standard
- Volatility rescaling to determine margins for a given IRS portfolio
- Historical shocks are scaled to simulate potential volatility environments prior to generating a P/L distribution for VaR calculations
- 5 Year+ look back includes extreme market events like Lehman default
- CME offers a shifted log approach where the zero-rates are first shifted by 4% before computing the returns
- Model achieves 99% coverage with 99.7% confidence level
- EWMA Historical VaR model adjusts historical shocks (returns) to account for an estimate of volatility over the future 5-day horizon; typically, margins are higher than plain ("un-scaled") Historical VaR as volatility is forecasted to ramp up and vice-versa
- Model uses volatility floors to mitigate against margin decline in a low-volatility environment

- CME Clearing accepts a broad array of collateral for the Customer OTC Account Class
- Full details of eligible collateral and the associated haircuts can be found at the link below
  - http://www.cmegroup.com/clearing/financial-and-collateral-management/

Portfolio Margining

Unparalleled margin efficiencies via the portfolio margining of Interest Rate Swaps versus Futures

Background

- CME Group has administered a range of cross-margining programs for more than 20 years
- IRS Portfolio Margining for Clearing Members was launched in May 2012, and the solution became available to customers in November 2012

Broad Adoption From Market Participants

- **15 Clearing Members** are now live with IRS Portfolio Margining, and over **700 accounts** are benefitting from the solution
- Total Risk Reductions now account for **$2.4 billion in initial margin savings on average in 2018**

Scope of the Solution

- Achieve capital savings across a diverse portfolio of:
  - ✓ 24 cleared OTC IRS currencies, including USD Swaptions
  - ✓ CBOT Treasury Futures, now including the Ultra Bond
  - ✓ CME Eurodollar Futures
  - ✓ Fed Fund Futures
  - ✓ USD Deliverable Swap Futures
  - ✓ Ultra 10 Treasury Futures
- CME is committed to providing Portfolio Margining between FX NDF and OTC IRS. Indicative analysis suggests potential savings as high as 51% in BRL

Swaption Clearing: The Most Capital Efficient Solution

Savings Analysis For 8 Portfolios of Swaptions and Swaps

Portfolio	Margin Savings*
1Y5Y Long Payer ATM Swaption Delta Hedged using Swap	89%
1Y5Y Short Payer ATM Swaption Delta Hedged using Swap	81%
1Y5Y Long Receiver ATM Swaption Delta Hedged using Swap	87%
1Y5Y Short Receiver ATM Swaption Delta Hedged using Swap	81%
2Y30Y Long Payer ATM Swaption Delta Hedged using Swap	88%
2Y30Y Short Payer ATM Swaption Delta Hedged using Swap	82%
2Y30Y Long Receiver ATM Swaption Delta Hedged using Swap	91%
2Y30Y Short Receiver ATM Swaption Delta Hedged using Swap	86%

* Savings = 1 – Portfolio Margin / (Swaption Margin + Swap Margin).

** Results are calculated as of September 2015. Values do not include transaction costs and are subject to change, depending on market volatility.

Counterparty Netting with Swaptions

Clearing enables counterparties to net down exposures that otherwise would be held against each bilateral counterparty, which creates significant margin efficiencies

Portfolio	# of Trades	Margin
Uncleared Counterparty 1	235	$182,489,622
Uncleared Counterparty 2	430	$64,758,273
Uncleared Counterparty 3	159	$421,680,284
Uncleared Counterparty 4	130	$225,687,930
Uncleared Counterparty 5	469	$320,184,602
Uncleared Counterparty 6	476	$31,007,151
Uncleared Counterparty 7	112	$33,604,900
Uncleared Counterparty 8	501	$165,404,511
Uncleared Counterparty 9	464	$148,804,368
Uncleared Counterparty 10	330	$130,585,625
Total	**3,306**	**$1,706,207,267**

Portfolio	# of Trades	Margin
Single Cleared Portfolio	3,306	$375,959,781

Counterparty netting alone generates margin efficiencies of 78%

Client Reporting

CME provides end of day reporting at the client level. This allows clients to see positions, variation margin and initial margin direct from the CCP and across multiple clearing members if applicable

	Spread sheet reporting csv format via FTP	Description	Time
Variation Margin	Trade Register *IRSTR_CMZ_YYYYMMDD_EOD.csv*	Trade and position level records, detailed trade economics, variation margin	7.30pm EST
Initial Margin	Margin Recap *MR_CMZ_YYYYMMDD.csv*	Initial margin per currency and account	9pm EST
Pricing	Pricing File *IRSPF_CMZ_YYYYMMDD.csv*	Anonymized pricing file for custodians and outsourced back-office functions	5pm EST Intraday 9pm EST end-of-day

Clearing Online Risk Engine ("CORE") Margin Tool

CME CORE Capabilities
CME PRODUCTS SUPPORTED
Futures and Options *Agriculture, Energy, Equity Index, FX, Interest Rates, Metals*
Interest Rate Swaps
FX Non-Deliverable Forwards and Cash-Settled Forwards
FUNCTIONALITY
Optimizer for Portfolio Margining
Interest Rate Portfolio Margining
Portfolio/Trade Editing
Portfolio/Trade History
Incremental Margin
Estimator/Delta Ladders

- Ideal business user solution for Portfolio Margin Savings Analysis
- Allows firms to calculate their margin for their portfolios by either a portfolio upload or entering trades manually
- Once run, CME CORE calculates the portfolio margin savings between OTC IRS and Interest Rate Futures
- Reports breakdown position transfers in PDF and CSV file format
- Enhanced Analytics includes:
  - Real-Time Positions - Access to CME OTC IRS cleared positions throughout the day providing a simple way to calculate margin requirements and perform "what if" margin analysis
  - Real-Time Margin Dashboard - Actively updated margin requirements across accounts providing the ability to anticipate overnight funding costs

http://www.cmegroup.com/education/featured-reports/cme-core-clearing-online-risk-engine.html

Membership and Connectivity

Execution & Affirmation

LatAmSEF
GFI
TraditionSEF Swap Execution Facility
javelin
ICE LINK
Bloomberg
CME CLEARPORT
bgc voice + electronic brokerage
ICAP
tullett prebon
Sky Road
Tradeweb
trueEX
SWAPEX
markitSERV
MarketAxess
TERA EXCHANGE
VYAPAR

OTC Clearing Members

Bank of America
BNP PARIBAS
UBS
BMO
HSBC
WELLS FARGO
BARCLAYS
CRÉDIT AGRICOLE
Newedge
CREDIT SUISSE
Deutsche Bank
Scotiabank
RBC
TD
NOMURA
citi
RBS The Royal Bank of Scotland
SOCIETE GENERALE
Morgan Stanley
Goldman Sachs
JPMorgan
Rabobank

http://www.cmegroup.com/globex/trading-cme-group-products/trading-applications/#platformsConnectedToCmeClearing
http://www.cmegroup.com/tools-information/clearing-firms.html

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