

Risk management for a time of uncertainty

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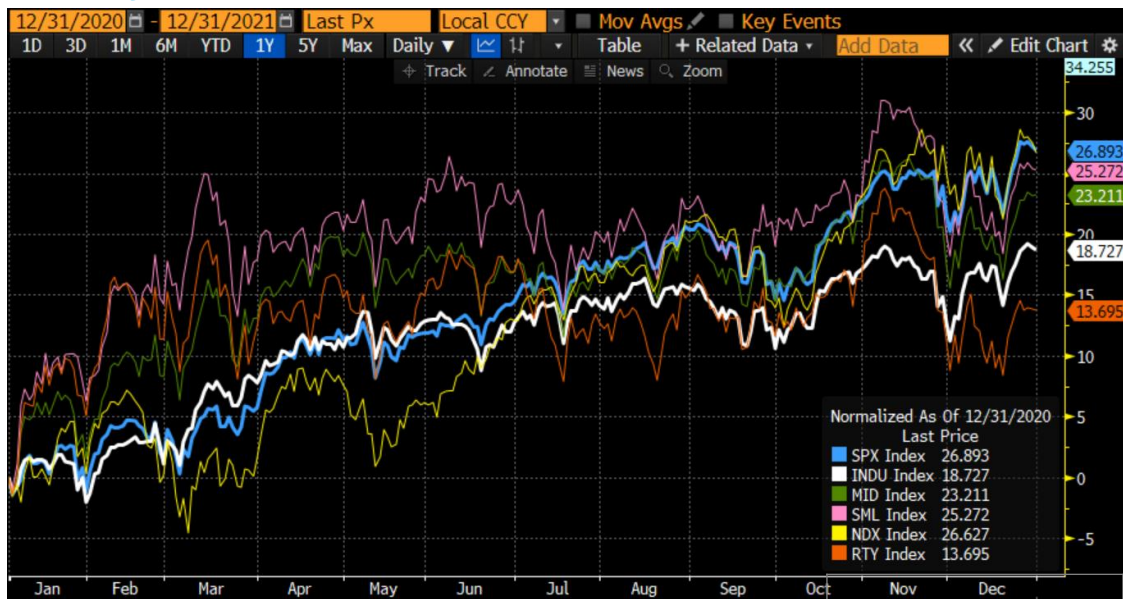
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Index Choice Matters

Equity Index Dispersion 2021



	2021	Q1	Q2	Q3	Q4
S&P 500	26.89%	5.77%	8.17%	0.23%	10.65%
DJIA	18.73%	7.76%	4.61%	-1.91%	7.37%
S&P Midcap 400	23.21%	13.12%	3.33%	-2.06%	7.63%
S&P Smallcap 600	25.27%	17.91%	4.21%	-3.14%	5.26%
Nasdaq-100	26.63%	1.58%	11.18%	0.93%	11.10%
Russell 2000	13.70%	12.44%	4.05%	-4.60%	1.86%

Source: Bloomberg

Equity Index Dispersion 2022



	2022	Q1	Q2	Q3	Q4
S&P 500	-19.44%	-4.95%	-16.45%	-5.28%	7.08%
DJIA	-8.78%	-4.57%	-11.26%	-6.66%	15.39%
S&P Midcap 400	-14.48%	-5.22%	-15.77%	-2.88%	10.30%
S&P Smallcap 600	-17.42%	-5.93%	-14.45%	-5.59%	8.69%
Nasdaq-100	-32.97%	-9.08%	-22.47%	-4.63%	-0.29%
Russell 2000	-21.56%	-7.80%	-17.49%	-2.53%	5.80%

Source: Bloomberg

E-mini S&P 500 Select Sectors Dispersion

2022 saw Energy up as much as 59%, while other sectors performed negatively throughout the year



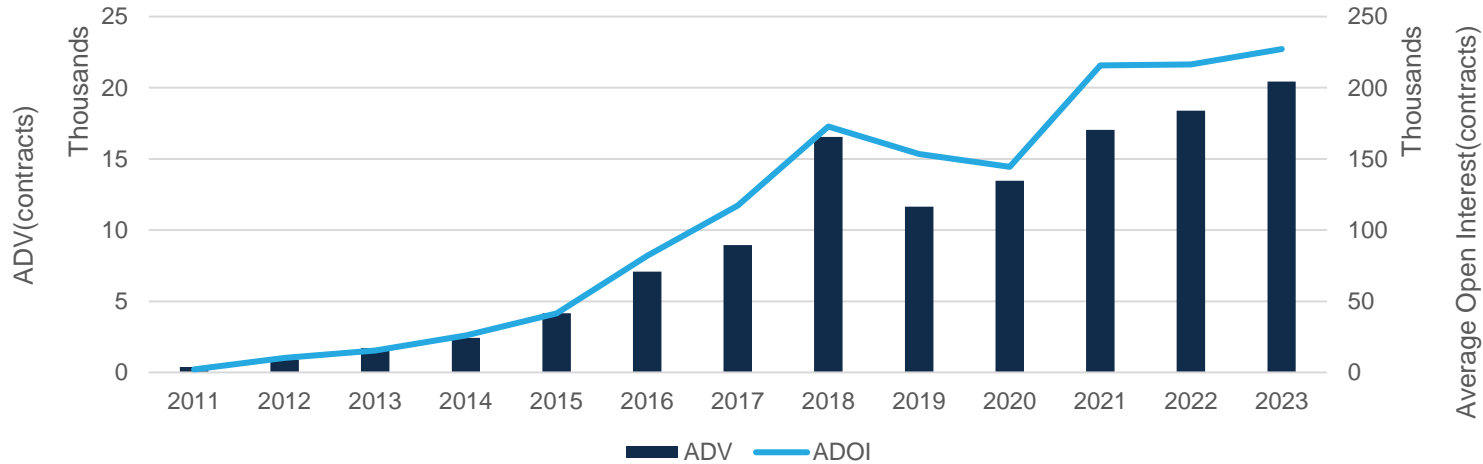
Source: Bloomberg

Sector Futures Growth

Sector Futures' liquidity has grown significantly over the last few years

- Around-the-clock access to 19 Sectors
 - E-mini S&P 500 Select Sector 2023 YTD ADV was a record 20.4K contracts (+11% vs. 2022)
 - Now trading, 6 new E-mini Sector index futures: S&P Select Industry on Regional Banks, Insurance, Biotechnology, Oil & Gas Exploration and Production, Retail, and the PHLX Semiconductor Sector Index

E-mini S&P 500 Select Sector Futures Annual ADV and OI

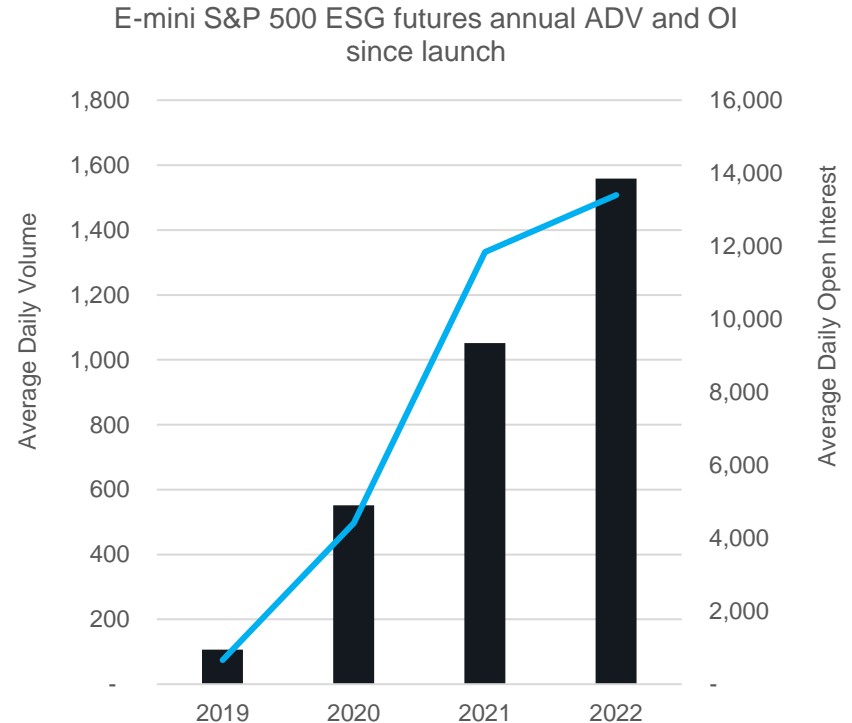


Data source: CME Group

E-mini S&P 500 ESG Futures Performance Since Launch

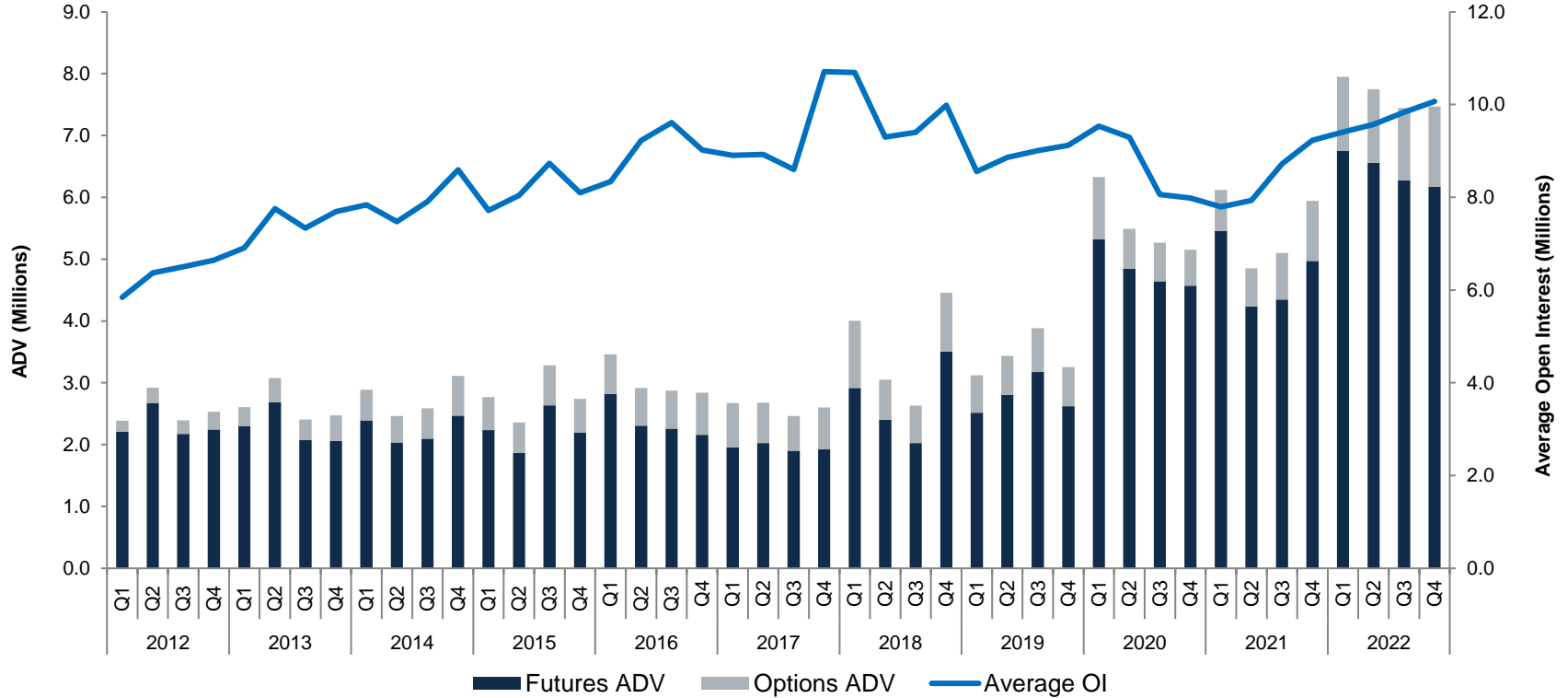
ESG Futures are proving to be an additive product to the CME equity futures ecosystem

- In 2022, ADV averaged over 1.6K contracts (+48% vs. 2021) with a record volume day of 18,551 contracts on March 14th (\$3.2B in notional)
- 2022 OI averaged over 13.4K (over \$2.4B notional)
- A diverse set of clients are accessing ESG futures via a few different transaction types: Outrights (72%), BTIC (10%), and Block (18%)
- High correlation with other ESG based indices (typically 99.5%+) has meant clients benchmarked to those indices are likely adopting this product for liquidity characteristics.



CME Group Equity Index Products

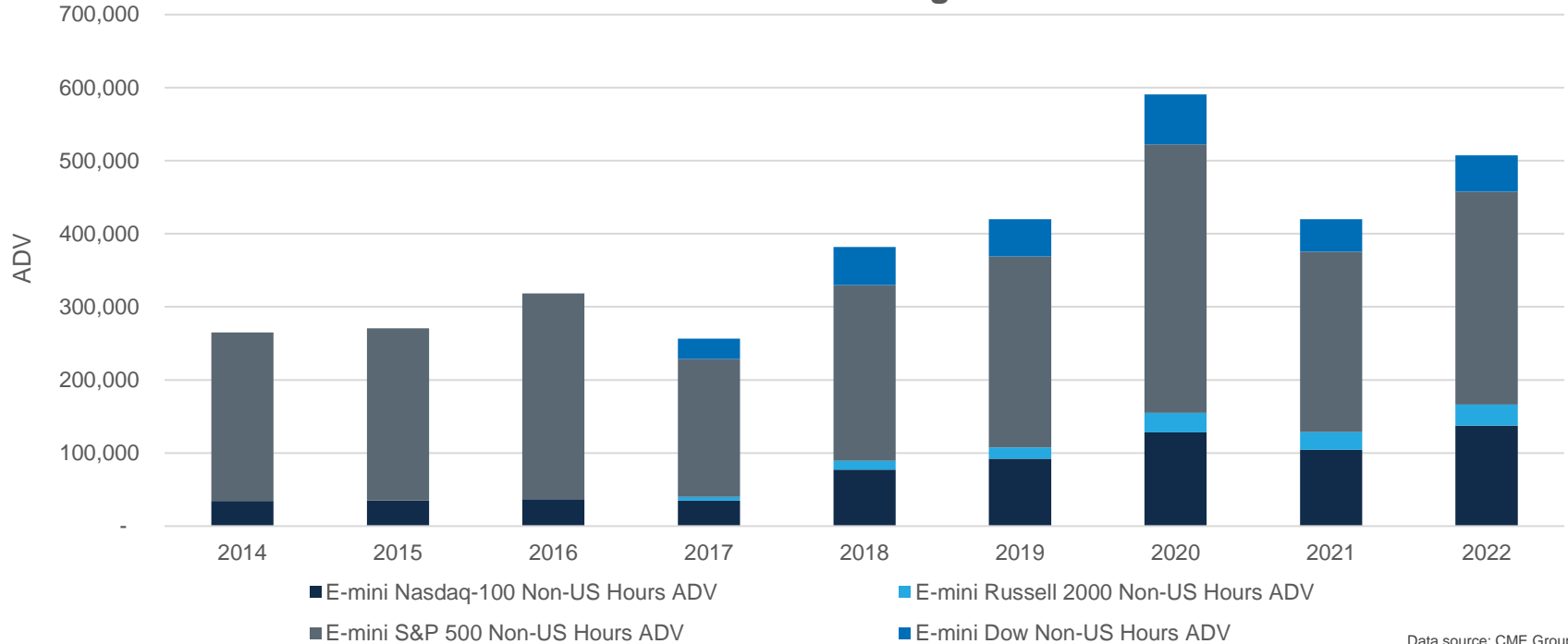
Equity Index Quarterly ADV and Open Interest



E-mini Futures Non-US hours Liquidity

2022 Non-US hours ADV was 507K, +21% vs. 2021

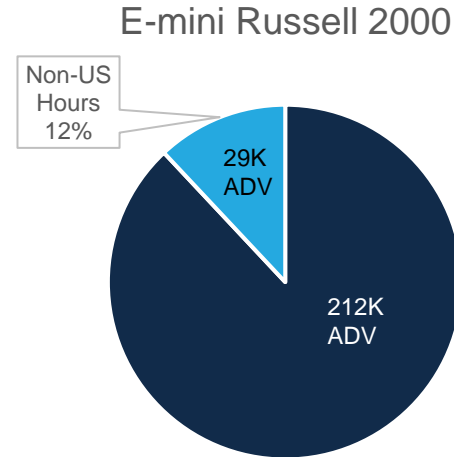
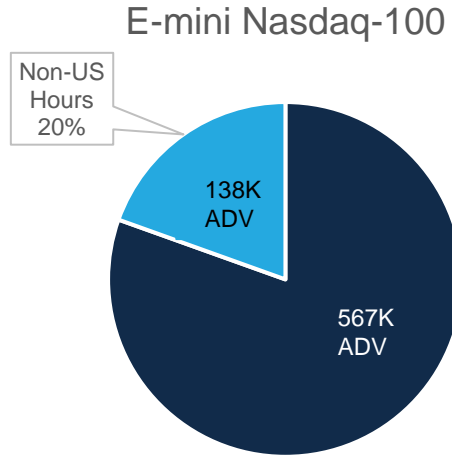
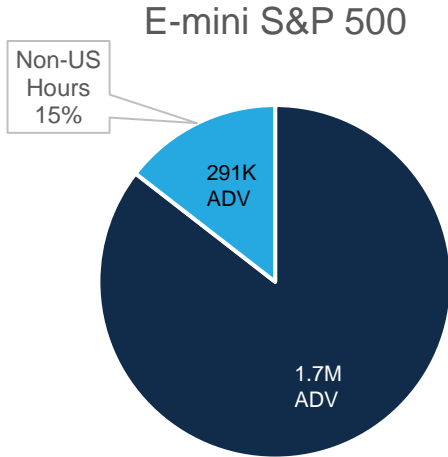
CME E-mini Futures ADV during Non-US Hours



Data source: CME Group

E-mini Futures Trading Highlights

- 2022 futures ADV was a record 2.0M (+32% YoY), 705K (+53% YoY) and 241K (+45% YoY) for E-mini S&P 500, Nasdaq-100 & Russell 2000
- 2022 E-mini Nasdaq-100 & Russell 2000 Non-US hours¹ ADV was are record 138K (+32% YoY) & 29K (+19% YoY)



■ Regular Trading Hours ■ Non-US Hours ■ Regular Trading Hours ■ Non-US Hours ■ Regular Trading Hours ■ Non-US Hours

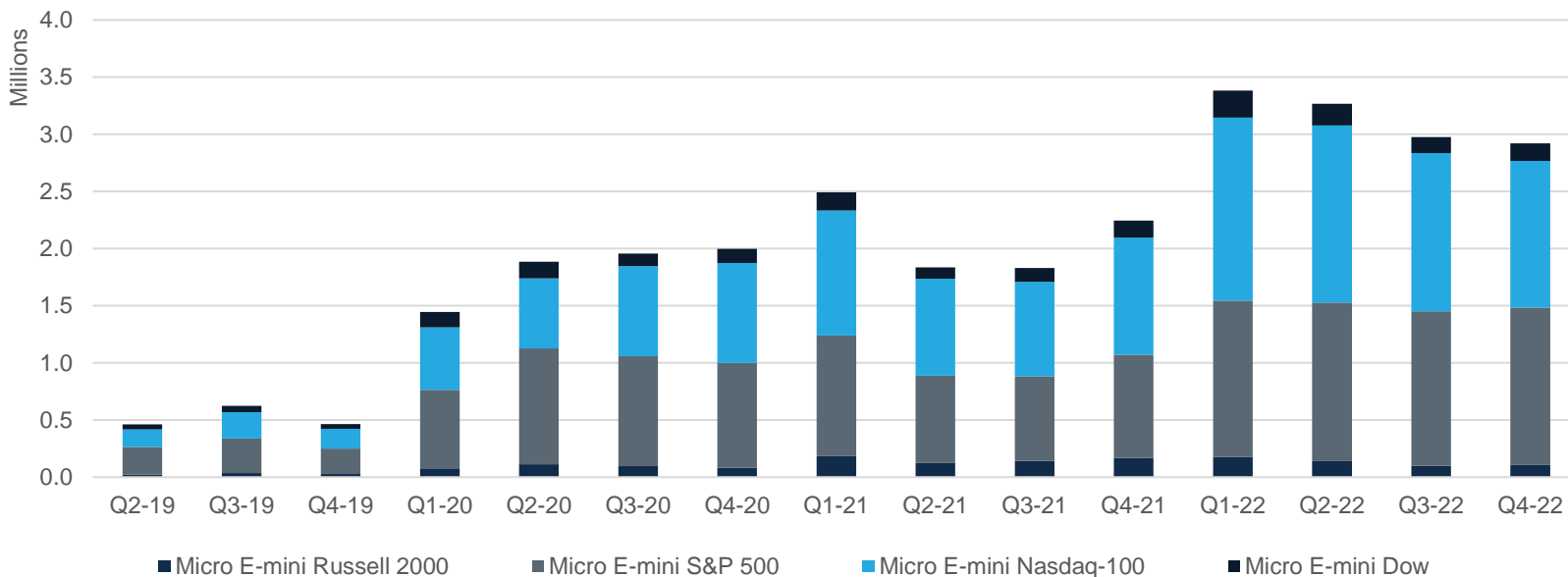
¹ Non-U.S. Trading Hours are 5:00 p.m. – 8:00 a.m. CT / 7:00 a.m. – 10:00 p.m. JST

Data source: CME Group

Micro E-mini Futures

- CME Group launched Micro E-mini futures on our major indices in May 2019, 2022 ADV was a record 3.1M (+64% YoY)
- Over 1.9B contracts traded since launch – 26% of volume transacted outside the U.S. and 21% of volume trading before the U.S. cash open in 2022

Micro E-mini Futures ADV by Quarter



Source: CME Group

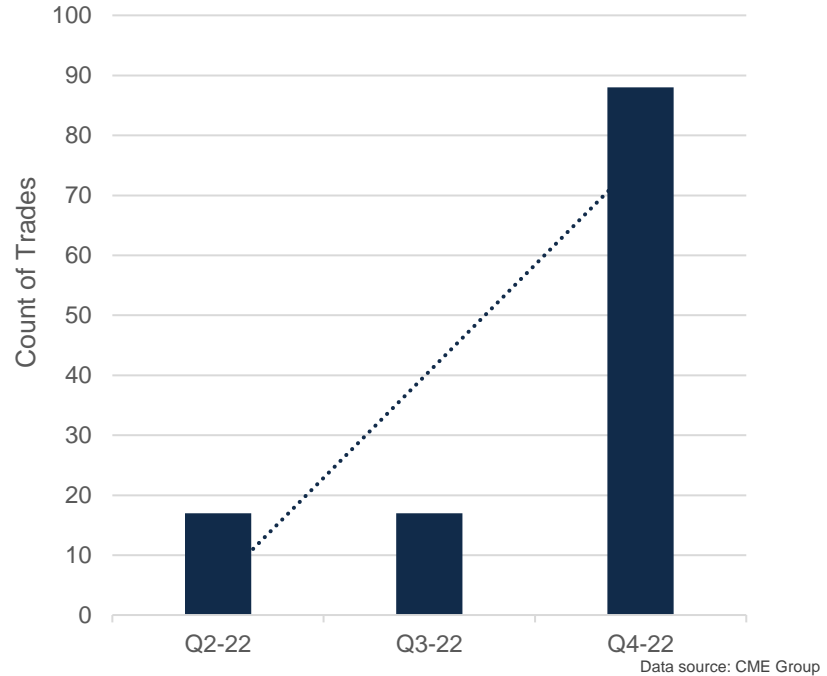
Equity Tools for Changing Markets

Derived Block Trades for Sectors

Providing greater flexibility to source intraday liquidity

- A block trade in which the price and quantity of the trade depends on one or a series of hedging transactions in an eligible related market e.g. (stocks or ETFs).
- The execution methodology of the hedging transaction and the methodology for the derivation of the price of the futures trade, will be agreed by the two counterparties prior to the execution of the hedging transaction
- Since eligibility, nearly 200 derived block transactions have occurred for a total volume traded of 131K
- \$9.5B has transacted across 14 different Equity Index Sector futures products in 2022

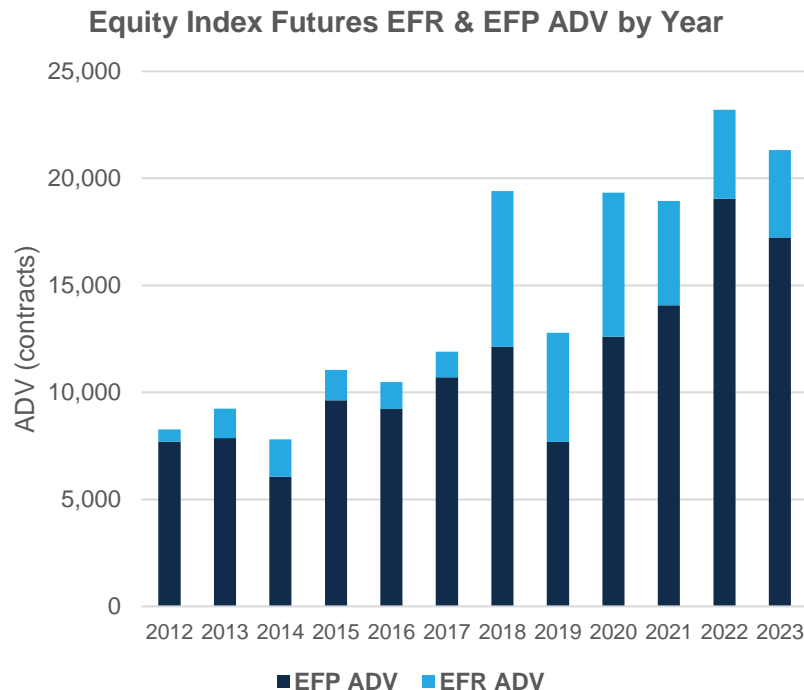
Derived Block Trades by Quarter



Growth in Exchange for Related Positions (EFRPs)

Heavy uptake into our EFRP mechanism due to capital and operational efficiencies

- An Exchange For Related Position (EFRP) allows a future to be simultaneously exchanged vs. a related product that is highly correlated.
- This could be a cash basket, an ETF or an OTC instrument.
- Is privately negotiated between 2 parties
- This can cover both futures and option products
- There is no minimum threshold requirement for the transaction
- Improved Operational Efficiency: Avoid having multiple line items in your portfolio via synthetics
- Improved Capital Efficiency: Optimize capital by moving between ETFs and Futures without price risk



Data source: CME Group

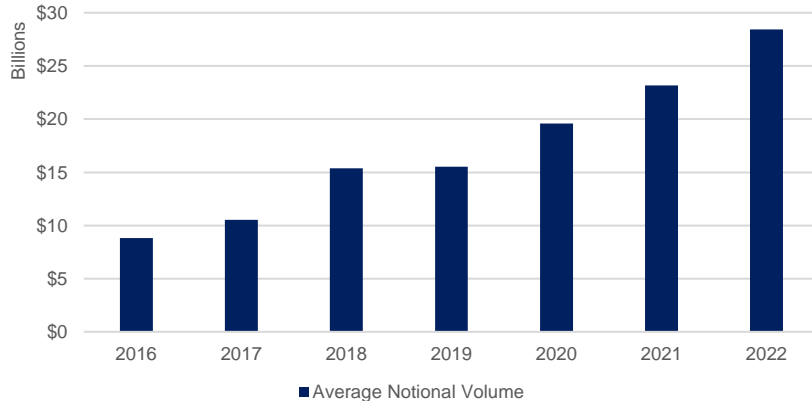
BTIC (Basis Trade at Index Close)

Basis Trade at Index Close (BTIC) was introduced on U.S. major indices in Q4-2015

- Over 61M contracts traded (\$10T notional) since the Nov. 2015 launch, 2022 ADV was \$24.4B
- Q1-2023 ADV of 42.8K contracts represents 37.5% of the Daily Market on Close (MOC).
- BTIC has represented 38% of the 2022 Month-End MOC trading flows on the primary cash venues
- Stock volumes have significantly shifted towards the cash index close

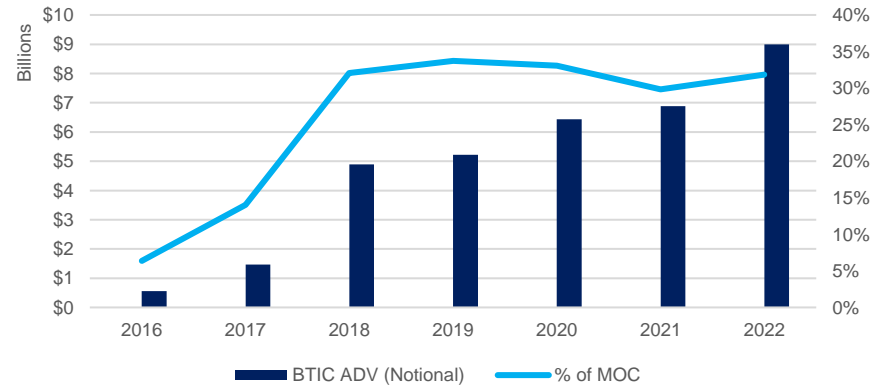
MOC Auctions at NYSE and NASDAQ for index constituents on the S&P 500 traded over \$28.3B notional daily in 2022 YTD

Average MOC Notional Volume by year



Positioning BTIC as an efficient alternative to MOC orders for buy-side managers rebalancing their portfolios at month-end

BTIC on E-mini S&P 500 Futures



Data source: CME Group

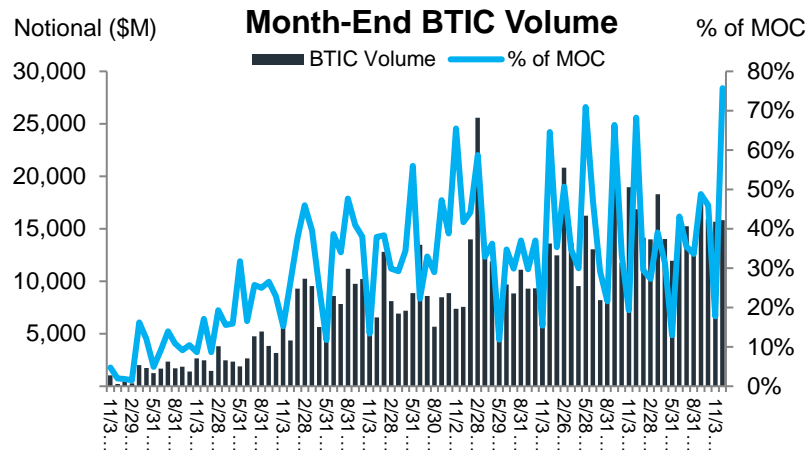
TACO (Trade at Cash Open)

- **TACO (Trade at Cash Open)**

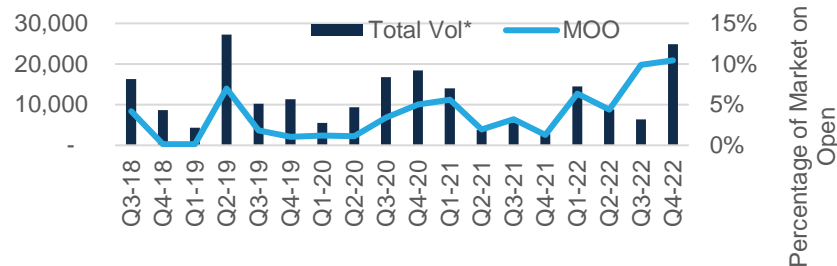
- Allows participants to execute a basis trade relative to the day's official cash index opening level – before the underlying market opens
- Available on E-mini S&P 500, Nasdaq-100, and Russell 2000
- Strong volumes on the 3rd Friday of the month, with that being the expiration of SPX options

- **BTIC+ and TACO+**

- Launched in Oct 2019
- Introduces T+ trading to the futures market
- Allows market participants to execute a BTIC or TACO trade days in advance on E-mini S&P 500



TACO at 3rd Friday Expiration by Quarter



*Sum of 3rd Friday's of each quarter

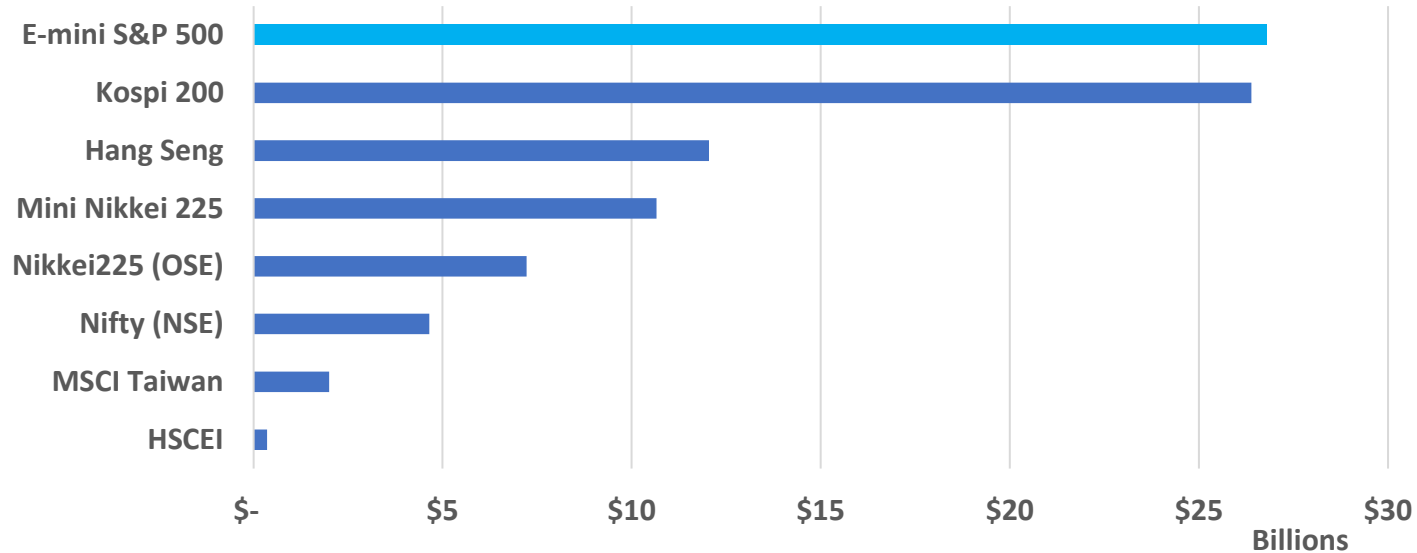
Data source: CME Group

Liquidity matters

Asian Hour Liquidity – E-mini S&P 500 Futures

E-mini S&P 500 futures trade over \$25 billion per day during APAC trading hours, making it comparable to the most liquid APAC index futures.

Equity Index Futures Average Daily Turnover (\$B) During Asian trading Hours FY 2022



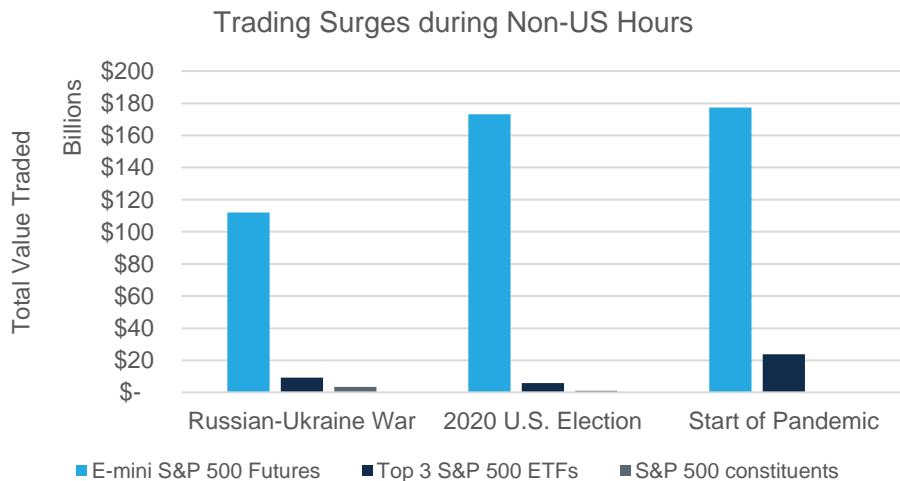
- E-mini S&P 500 futures volume is based on 9:00 AM – 5:00 PM Tokyo (8:00 AM-4:00 PM HKT)
- All others are based on local trading hours

Source: CME Group, Bloomberg

Key trading surges during non-U.S. trading hours

During the Non-US hours trading session for the events below, E-mini S&P 500 futures outperformed

- Start of Russian-Ukraine War, E-mini S&P 500 futures traded \$112B notional value, over 9x the liquidity traded via S&P 500-based ETFs and cash constituents.
- For the 2020 U.S. election, E-mini S&P 500 futures traded \$173B notional value, over 25x the liquidity traded via S&P 500-based ETFs and cash constituents.
- During the non-US Hours trading session at the start of the pandemic (week of Feb. 24-28, 2020) CME S&P 500 futures traded on average \$178B notional value per day, exceeding the liquidity traded in the S&P 500-based ETFs and cash constituents.



Multiplier of S&P 500 futures vs. Adjacent Market Activity

	ETFs	Cash Constituents
Russian-Ukraine War	12x	33x
2020 U.S. Election	30x	149x
Start of Pandemic	8x	

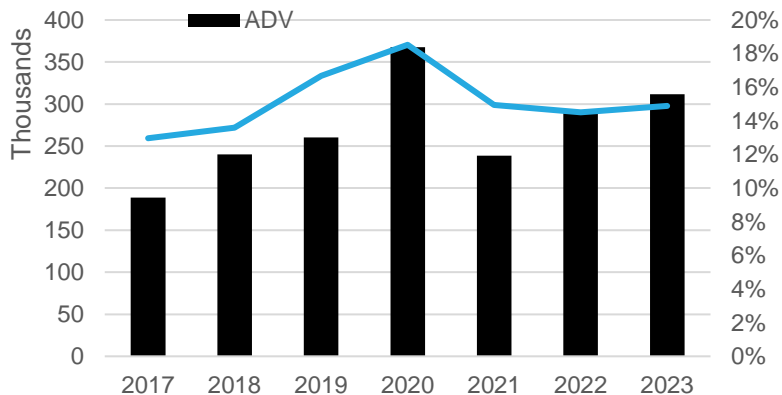
Asian Hour Liquidity

Actionable Liquidity Around the Clock

E-mini S&P 500 Futures

- 2023 YTD E-mini S&P 500 futures Non-US hours ADV is 312K contracts
- Non-US hours volume in 2023 YTD has averaged 15% of total volume

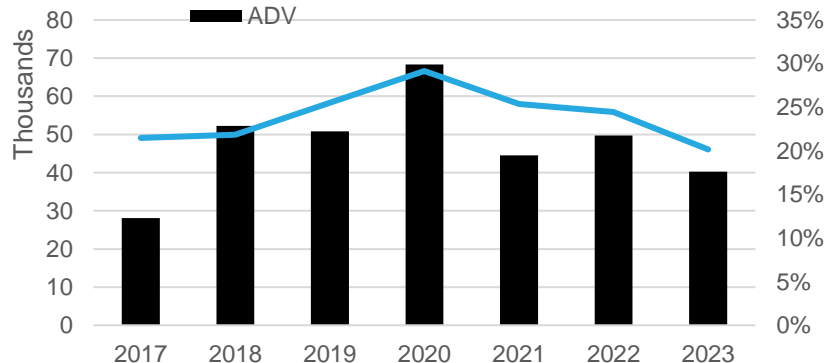
E-mini S&P 500 Futures during Non-US hours



E-mini Dow (\$5) Futures

- 2023 YTD E-mini Dow (\$5) futures Non-US hour ADV is 40K contracts
- Non-US hours volume in 2023 averaged 20%

E-mini Dow (\$5) Futures during Non-US hours



Data source: CME Group

Source: CME Group, as of Mar 24, 2023

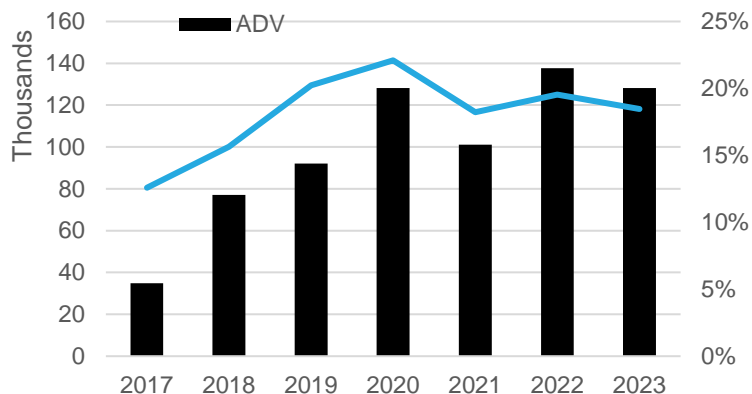
Asian Hour Liquidity

Actionable Liquidity Around the Clock

E-mini Nasdaq-100 Futures

- 2023 YTD Non-US hour ADV is 128K contracts
- Global 2023 YTD ADV is 694K contracts
- Non-US hours volume in 2023 YTD has averaged 18% of overall volume

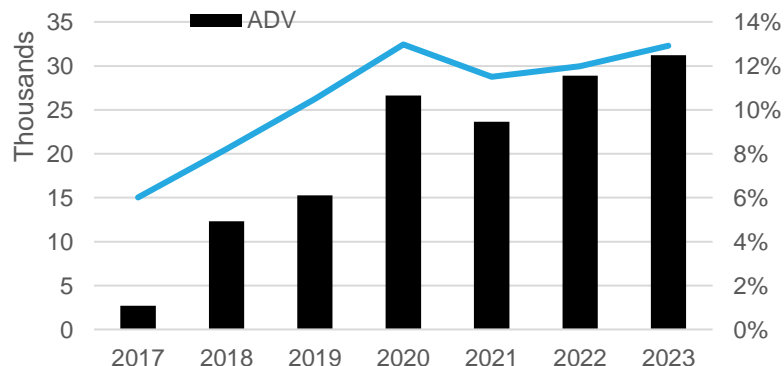
E-mini Nasdaq Futures during Non-US hours



E-mini Russell 2000 Futures

- 2023 YTD E-mini Russell 2000 futures Non-US hour ADV is 31K
- Non-US hours volume 2022 YTD has averaged 13%

E-mini Russell 2000 Futures during Non-US hours



Data source: CME Group

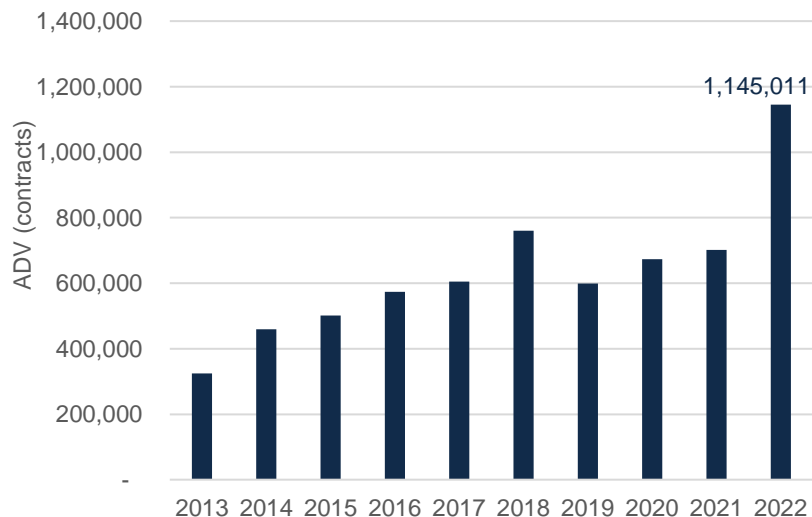
Source: CME Group, as of Mar 24, 2023

E-mini S&P 500 Options - Enhancements and Asian Hours Growth Story

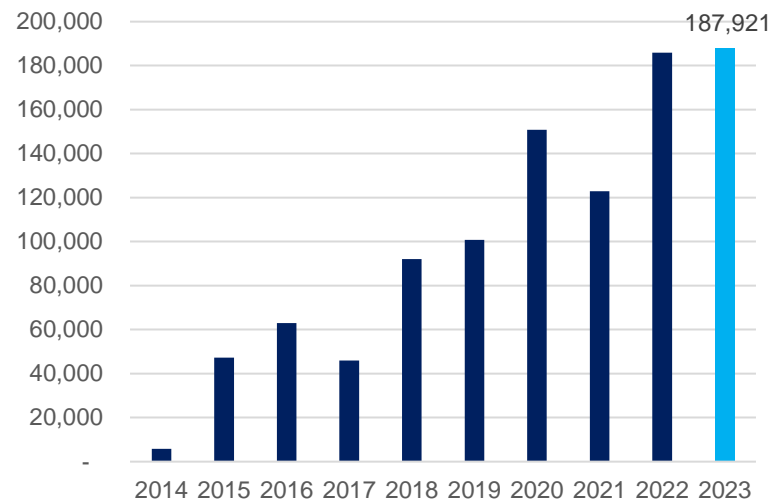
Equity options traded a record ADV of 1.2M in 2022

- E-mini S&P 500 options ADV was a record 1.15M (+63% vs. 2021)
- E-mini S&P 500 options non-US hours ADV was a record 185K (+51% vs. 2021)

E-mini S&P 500 Options Annual ADV



E-mini S&P 500 Options during Non-US hours



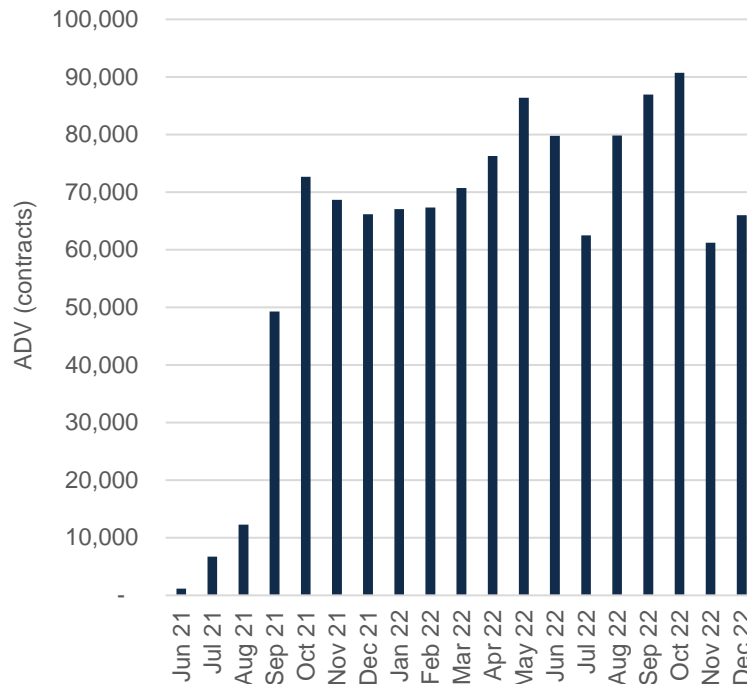
Data source: CME Group

E-mini S&P 500 Options Blocks

Launched June 2021, E-mini S&P 500 Options have traded over 24.6M contracts

- Negotiate and trade large size without slippage or breakup risk
- Delta can be covered with E-mini S&P 500 futures (delta-neutral) and centrally cleared with margin offset benefits between futures vs. options
- Minimum Block Quantity of 250 contracts per options leg with no minimum threshold for delta leg using E-mini S&P 500 futures
- Customers can monitor block trade activity of E-mini S&P 500 options throughout the trading day.
- E-mini Nasdaq-100 (NQ) options: NQ options became block eligible in January 2022, with a minimum block threshold of 60 contracts. Nearly 15.5K contracts have traded since launch.

E-mini S&P 500 Options Block Monthly ADV



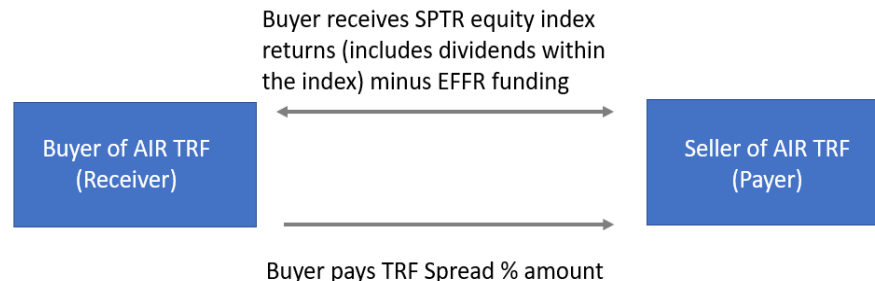
Data source: CME Group

Equity Tools under UMR environment

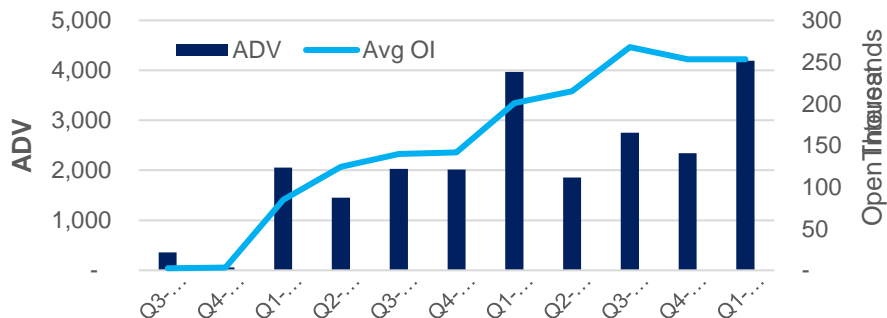
AIR S&P 500 Total Return Futures

Launched on September 21, 2020

- New Adjusted Interest Rate Total Return Futures (AIR TRFs) on the S&P 500 Index are designed to give you total return exposure with an overnight floating rate built in.
- The enhanced contract design provides similar economics to an equity index total return swap with the margin efficiency of listed futures.



S&P 500 Adjusted Interest Rate Total Return Futures
Quarterly ADV and OI since launch



- Available to trade via Globex or via Blocks
 - Seen strong Globex markets from an early stage – often displaying 500 contracts a side with a spread of 6-7 basis points.
- Online calculator available on CME website helps to calculate final AIR TRF future price in index points
- Q1-2023 ADV was 4.2K with OI averaging 255K contracts. Notional OI now at \$54B.
- Trading and Open Interest is occurring across the full maturity profile all the way to 6 years out

Data source: CME Group

Source: CME Group, as of Mar 1, 2023

AIR Total Return Futures

AIR TRF Design & Tools

- The AIR Total Return futures (AIR TRFs) valuation has three components:

Index Price – Accrued Financing + Financing Spread Adjustment.

1) Equity Index Component

- Based on SPTR index
- AIR TRF is always traded on the official index daily close, as the trade can only be transacted via BTIC

2) Accrued Financing Component

- The Accrued Financing is the sum of the daily financing from the initial launch date Sep 21, 2020 onwards
- The benchmark rate used in AIR TRFs is the Overnight Effective Federal Funds Rate (EFFR)
- The Accrued Financing amount is netted daily with the equity index level

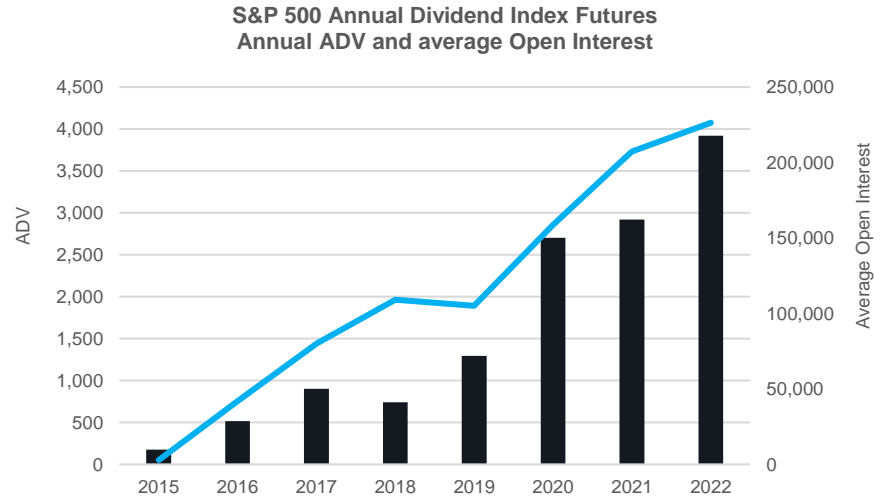
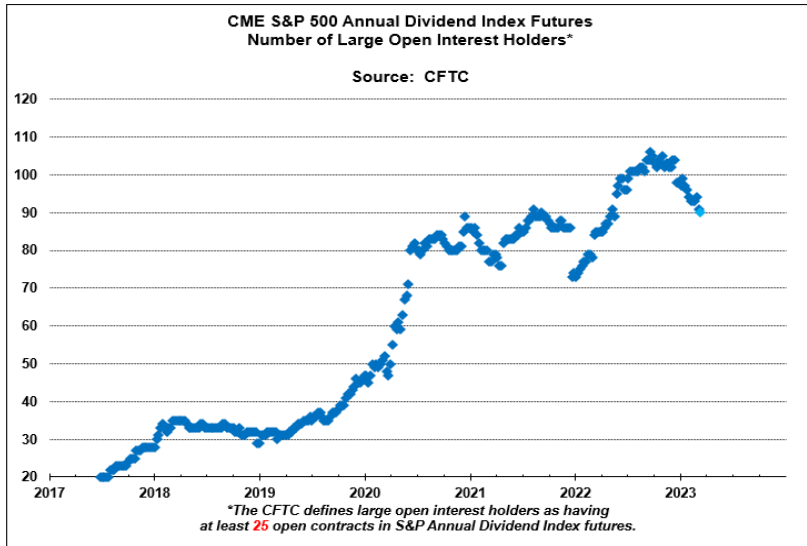
3) Financing Spread Adjustment (FSA) Component

- When trading the AIR TRF the counterparties will agree to a spread above or below (EFFR) for the remaining maturity of the futures contract
- This spread will be known as the TRF Spread and will be traded in basis points

S&P 500 Dividend Futures

Delivering Capital-Efficient Products for an Evolving Regulatory Environment

- Q1-2023 ADV was 4.5K contracts per day (+5% vs. Q4-22)
- New participants continued to enter the market with Large Open Interest Holders (LOIH) averaging 94 in Q1-23
- OI reached a monthly average of 180K in Q1-23
- Capital efficient, margin of 4% per contract, can be more efficient than OTC alternatives



Source: CME Group, as of Mar 1, 2023

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