

Volatility Derivatives at Eurex

December 2023



Agenda

- 1 The VSTOXX® Index & Eurex's Product Offering**
- 2 Milestone Development**
- 3 A Path to Liquidity**
- 4 Hedging, Relative Value, Market Making, Retail**
- 5 Efficient Margining**
- 6 Appendix**

EURO STOXX 50[®] Volatility – How VSTOXX[®] is derived

The VSTOXX[®] Index is Europe’s volatility benchmark, it is designed to reflect investors sentiment and economic uncertainty by measuring the 30 day implied volatility of the EURO STOXX[®] 50

How is the VSTOXX[®] Index calculated?

Eight sub-indices are calculated by using the **market prices** of a **basket** of EURO STOXX[®] 50 Index Options within the same expiry. The basket of options used is screened by the following filters

- Option prices that are one-sided are screened out.
- Only options that are quoted within the maximum spreads of 8% are eligible.
- “Cutting the Wings” – exclusion of option prices that are too far OTM, ensures that prices used do not fall short of a minimum value of 0.5 index points

Each sub-index represents one expiration. Therefore the first sub-index uses front month EURO STOXX[®] 50 Index Options, the second sub-index uses second month options, and so on

The main VSTOXX[®] Index is designed as a rolling index at a fixed 30-days to expiry that is achieved through linear interpolation of the two nearest of the eight sub-indices

This model has been jointly developed by Goldman Sachs and Deutsche Boerse

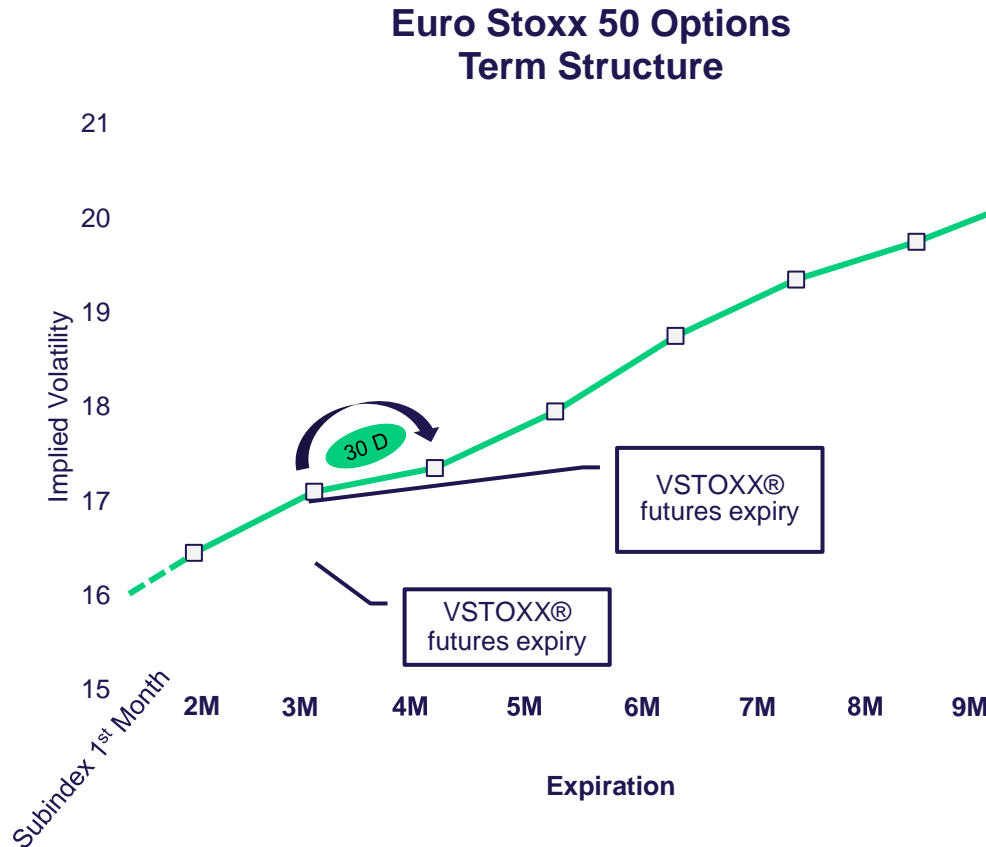
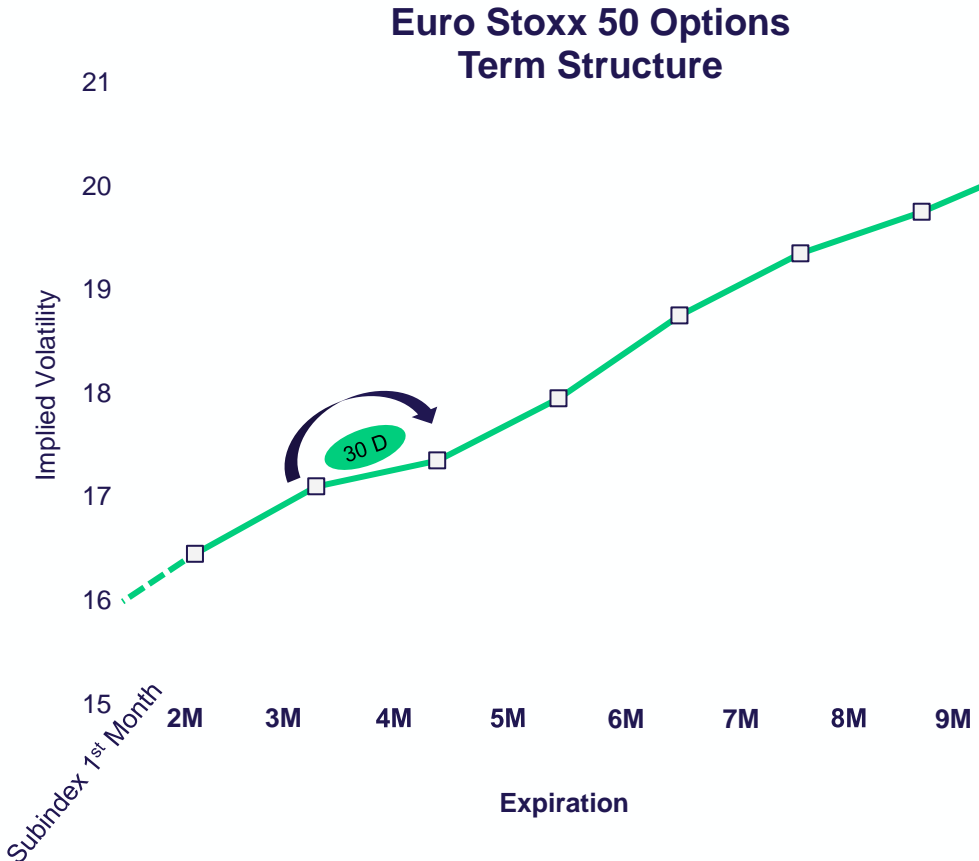
Market prices used in the VSTOXX[®] sub-index

CBQty	CBid	CAsk	CAQty	Contract	PBQty	PBid	PAsk	PAQty
				OESX Nov14 2500	1900	0.4	0.6	4153
				OESX Nov14 2525	2401	0.4	0.6	2352
				OESX Nov14 2550	1200	0.5	0.7	3803
				OESX Nov14 2575	2851	0.5	0.7	2352
				OESX Nov14 2600	1600	0.6	0.8	1753
				OESX Nov14 2625	1000	0.7	0.9	2103
				OESX Nov14 2650	2853	0.7	1.0	2472
201	378.9	381.8	201	OESX Nov14 2675	2847	0.8	1.1	2465
201	354.0	356.9	201	OESX Nov14 2700	2846	0.9	1.2	1769
201	329.1	332.1	201	OESX Nov14 2725	2045	1.0	1.3	1753
201	304.3	307.2	201	OESX Nov14 2750	2444	1.2	1.5	1753
201	279.5	282.4	201	OESX Nov14 2775	1000	1.5	1.7	753
201	254.8	257.7	201	OESX Nov14 2800	100	1.8	2.0	2440
201	230.2	233.0	201	OESX Nov14 2825	2361	2.0	2.3	1553
201	205.7	208.5	201	OESX Nov14 2850	100	2.6	2.8	1913
201	181.3	184.1	201	OESX Nov14 2875	100	3.2	3.4	665
201	157.2	159.9	201	OESX Nov14 2900	1973	4.0	4.3	314
201	133.5	136.1	201	OESX Nov14 2925	1605	5.2	5.5	10
201	110.4	112.9	201	OESX Nov14 2950	215	7.1	7.4	259
201	88.2	90.6	201	OESX Nov14 2975	723	9.7	10.2	359
201	67.3	69.3	100	OESX Nov14 3000	597	13.7	14.3	415
201	48.4	50.1	100	OESX Nov14 3025	203	19.6	20.3	203
150	32.5	33.2	100	OESX Nov14 3050	166	28.1	28.8	166
174	19.4	20.1	174	OESX Nov14 3075	100	40.0	41.0	451
684	10.3	10.8	223	OESX Nov14 3100	201	55.1	57.3	201
877	4.9	5.2	225	OESX Nov14 3125	201	74.5	77.0	201
1305	2.2	2.4	18	OESX Nov14 3150	201	96.6	99.3	201
1893	1.0	1.3	2243	OESX Nov14 3175	201	120.3	123.1	201
2603	0.5	0.7	1350	OESX Nov14 3200	201	144.7	147.6	201

EURO STOXX 50® Volatility – The VSTOXX® index (1/2)

- VSTOXX® Index is based on **market prices** of EURO STOXX® 50 Index Options.
- The VSTOXX® index does **NOT** measure implied volatilities of ATM options, but the implied variance across all options of given time to expiry.
- The main index VSTOXX® is designed as a **rolling index** at a fixed **30 days to expiry** through linear interpolation of the two nearest of the eight available sub-indexes.
- The **futures** on the VSTOXX® index is the expectation of where the 30 day implied volatility will be at the futures expiration date
- The change in the term structure of the EuroStoxx 50 options is the main driver for futures prices – rather than the VSTOXX® index itself

EURO STOXX 50® Volatility – The VSTOXX® index (2/2)



VSTOXX® Futures & Options on VSTOXX® Futures

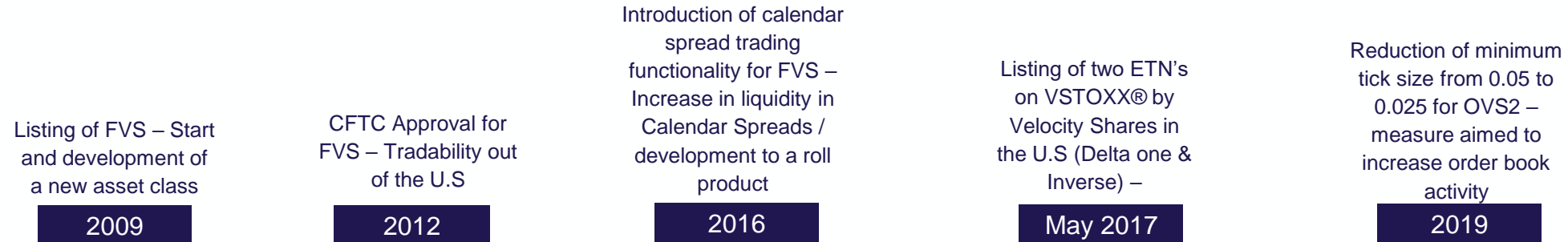
Symbol	OVS2	FVS
Product Name	Options on VSTOXX® Futures	VSTOXX® Futures
Underlying	VSTOXX® Futures	The VSTOXX® Index, a market estimate of expected volatility that is calculated every 5 seconds by using real-time EURO STOXX 50® option bid/ask quotes
Contract Value	EUR 100 per index point of the underlying	
Price Quotation and Minimum Price Change	The Minimum Price Change is 0.05 points (equivalent to a value of EUR 5)	The Minimum Price Change is 0.025 points (equivalent to a value of EUR 2.5)
Contract Months	The next eight successive calendar months	
Exercise Price Intervals	Staggered by Volatility Index Level:	
	= < 20 - 1 Index Point	-
	> 20 and =< 50 - 2.5 Index Points	-
	> 50 - 5 Index Points	-
Exercise	American-style; an option can be exercised until the end of the Post-trading Full Period on any exchange day during the lifetime of the option.	-
Settlement	Physical delivery of the underlying. The underlying matures on the same exchange day and will be settled in cash.	Cash settlement, payable on the first exchange day following the Final Settlement Day.
Daily Settlement Price	Established by Eurex, determined through a binomial pricing model	Determined during the closing auction of the respective futures contract
Last Trading Day and Final Settlement Day	30 calendar days prior to the third Friday of the expiration month of the underlying options. This is usually the Wednesday prior to the second last Friday of the respective expiration / maturity month	
Final Settlement Price	Average of the VSTOXX® values on the Last Trading Day between 11:30 and 12:00 CET	
Block Trade Size	TES 1,000 Contracts; Enlight Min Block 500 Contracts	1,000 Contracts
Vendor Codes	Bloomberg: FVSA INDEX OMON Reuters: 0#FVS2+	Bloomberg: FVSA INDEX Reuters: 0#FVS:

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- 1** The VSTOXX® Index & Eurex's Product Offering
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Volatility® Derivatives past milestones since inception

Evolution of the VSTOXX® market segment and product portfolio



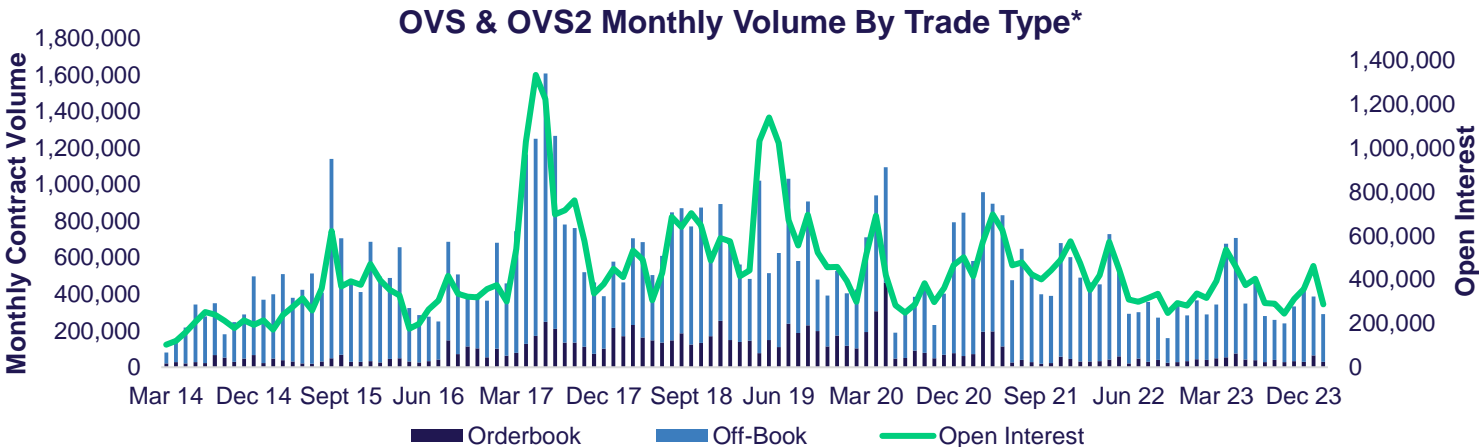
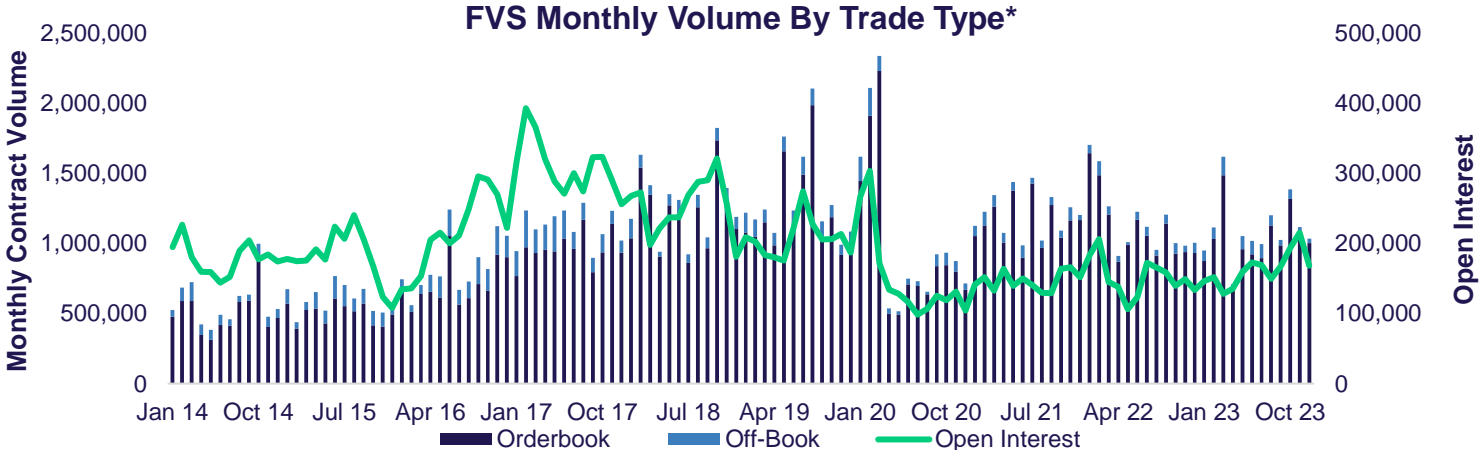
Eurex VSTOXX® Derivatives



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A Path to Liquidity: Average Daily Volume and Open Interest Growth



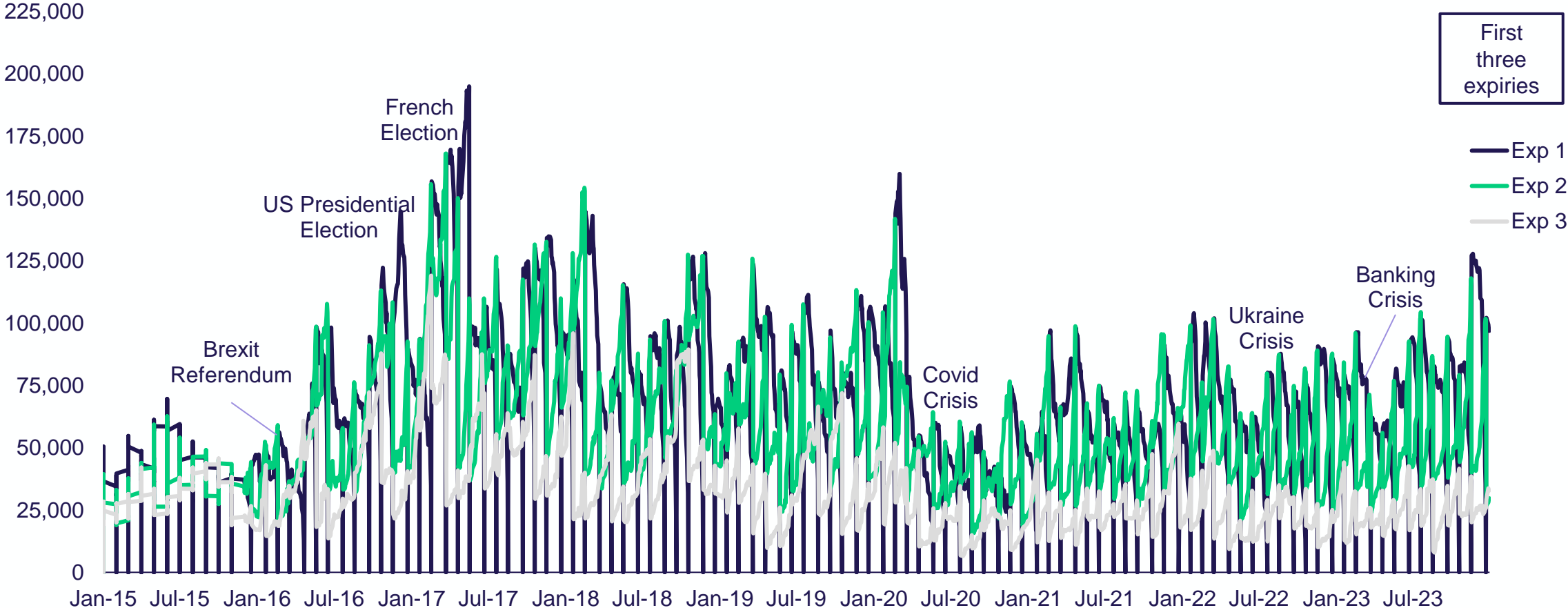
	FVS ADV	OVS2 ADV
2012 ADV	15,000	5,638
2013 ADV	21,000	7,947
2014 ADV	27,500	13,380
2015 ADV	29,500	27,000
2016 ADV	38,200	19,000
2017 ADV	52,640	39,795
2018 ADV	61,176	33,794
2019 ADV	62,944	29,211
2020 ADV	49,769	27,068
2021 ADV	56,882	28,625
2022 ADV	54,346	16,954
2023 ADV	51,834	18,701

Order book volume 2012 vs 2023

FVS	2012	2023
Order book	71.93%	93.10%
OVS2	2.66%	10.78%

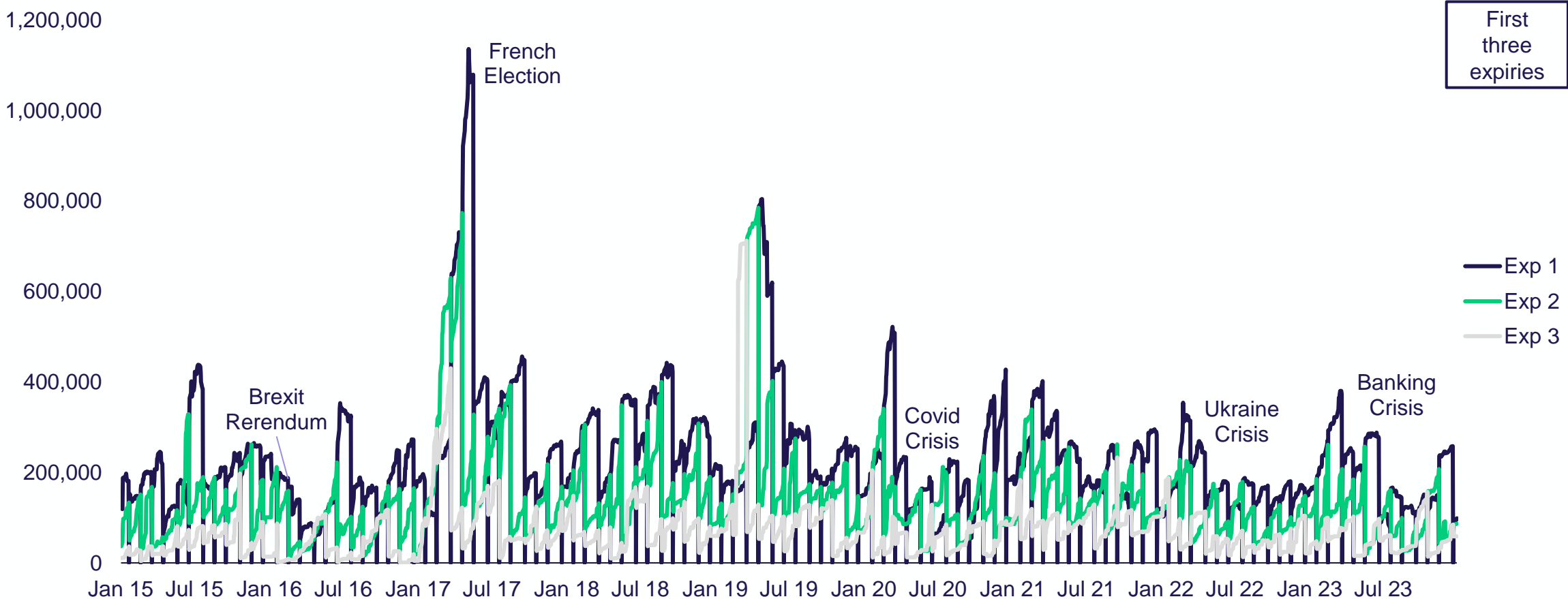
VSTOXX® Futures Open Interest

Macro events gradually increase base open interest



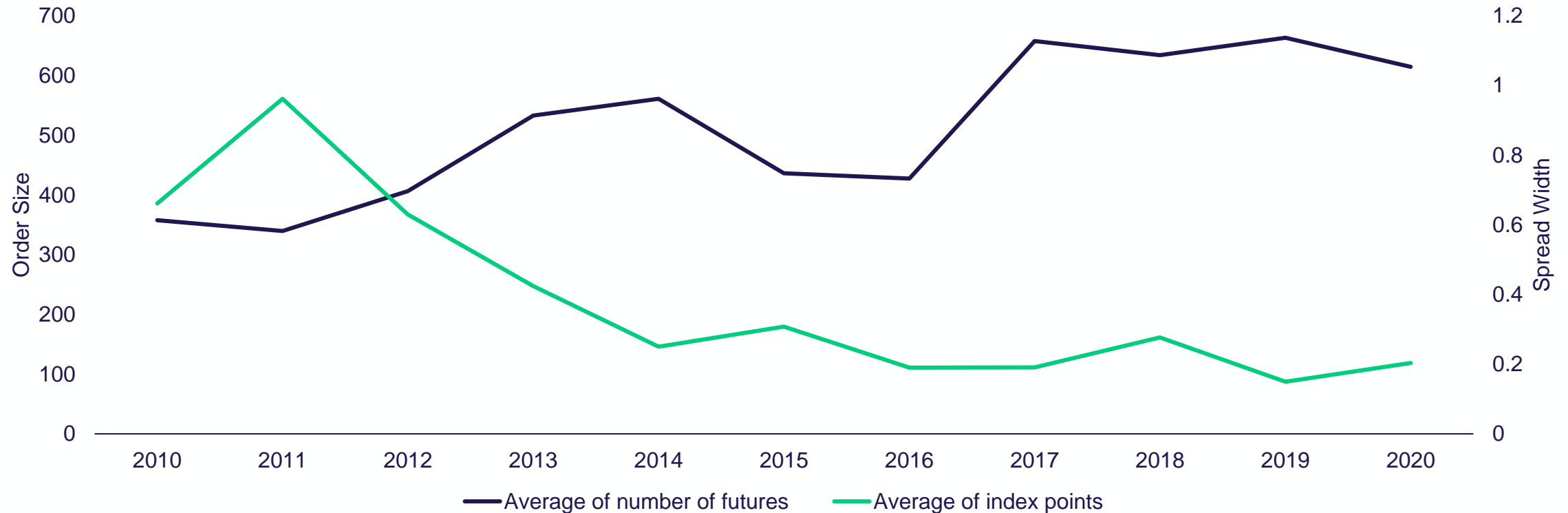
Option on VSTOXX® Futures Open Interest

Clients position ahead of upcoming macro events



VSTOXX® Futures

Eurex Liquidity Measure – Spread width & order book depth

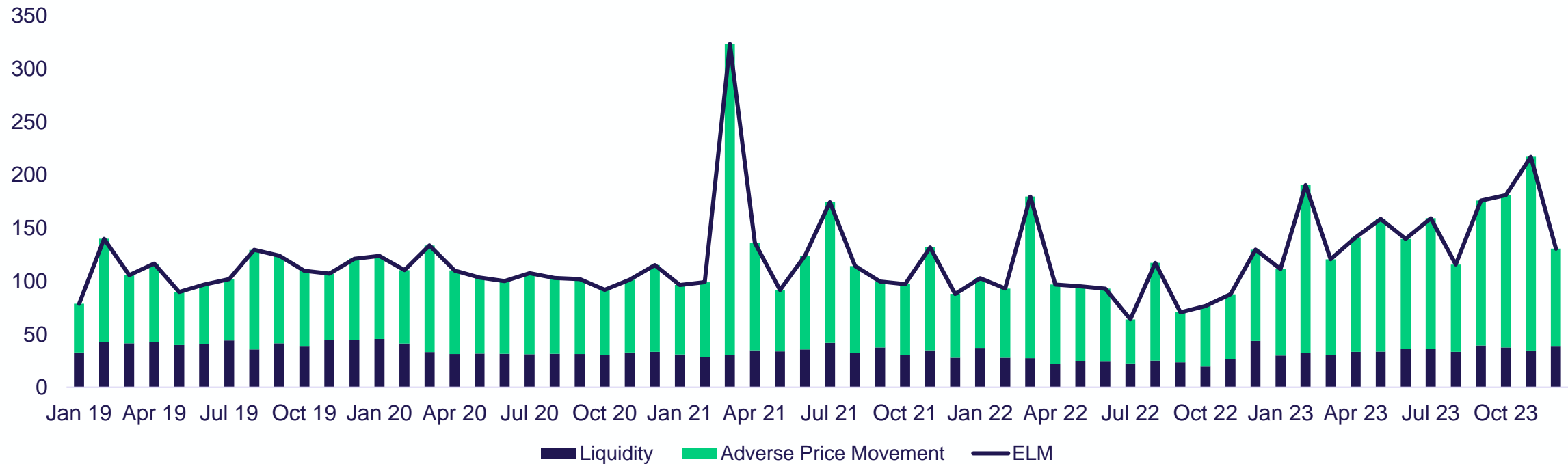


- Eurex Liquidity Measure is a measure to identify the spread width and the book depth of a given market. It accounts for the round-trip market impact cost of executing a market order (e.g. notional of EUR 10 million) against the order-book in basis points.
- This can be translated into futures and index points by using the futures settlement price.
- Over time, you can trade an increasing amount of futures contracts at a smaller bid offer spread
- The addition of more Market Makers from 2016 onwards improved the liquidity situation substantially

Average ELM dynamics on different market order sizes

Reduced round-trip market impact costs

FVS 1,000,000 Volume Class

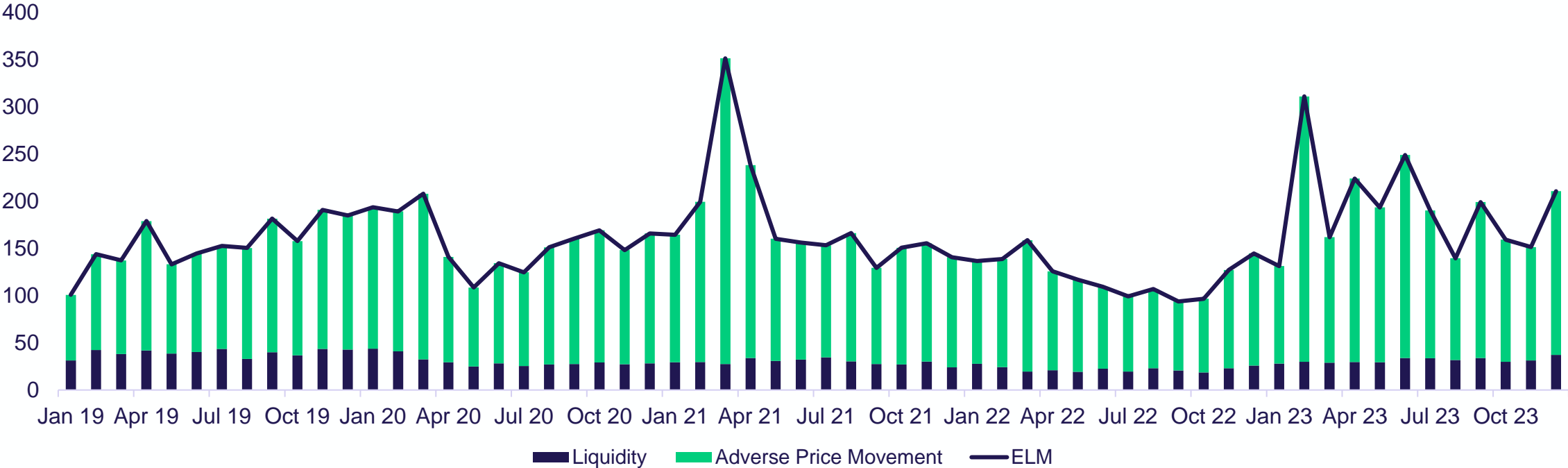


- ELM provides a theoretical market impact for “aggressor” orders of different lot sizes. It is calculated daily and at fixed time intervals, for different lot size classes.
- The liquidity in VSTOXX® futures has increased substantially in 2019 & 2020 compared to 2011, thereby observing a decreasing trend in VSTOXX® futures ELM values, but large block trades drove aggressive price impacts in March 2021.

Average ELM dynamics on different market order sizes (1/2)

Reduced round-trip market impact costs

FVS 3,000,000 Volume Class

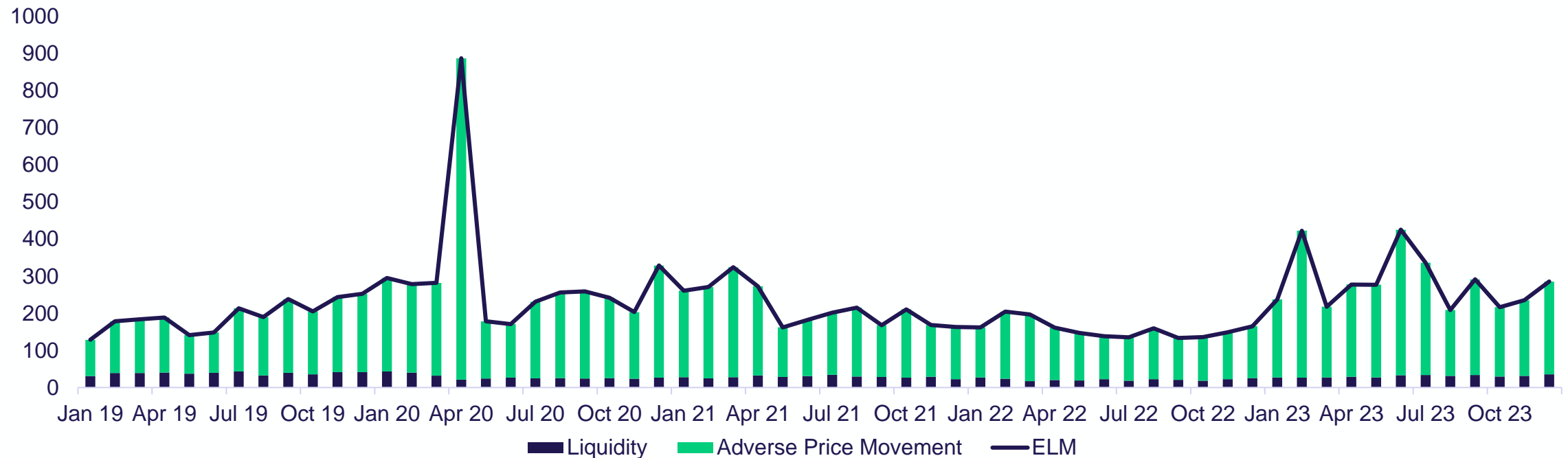


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Average ELM dynamics on different market order sizes (2/2)

Reduced round-trip market impact costs

FVS 5,000,000 Volume Class

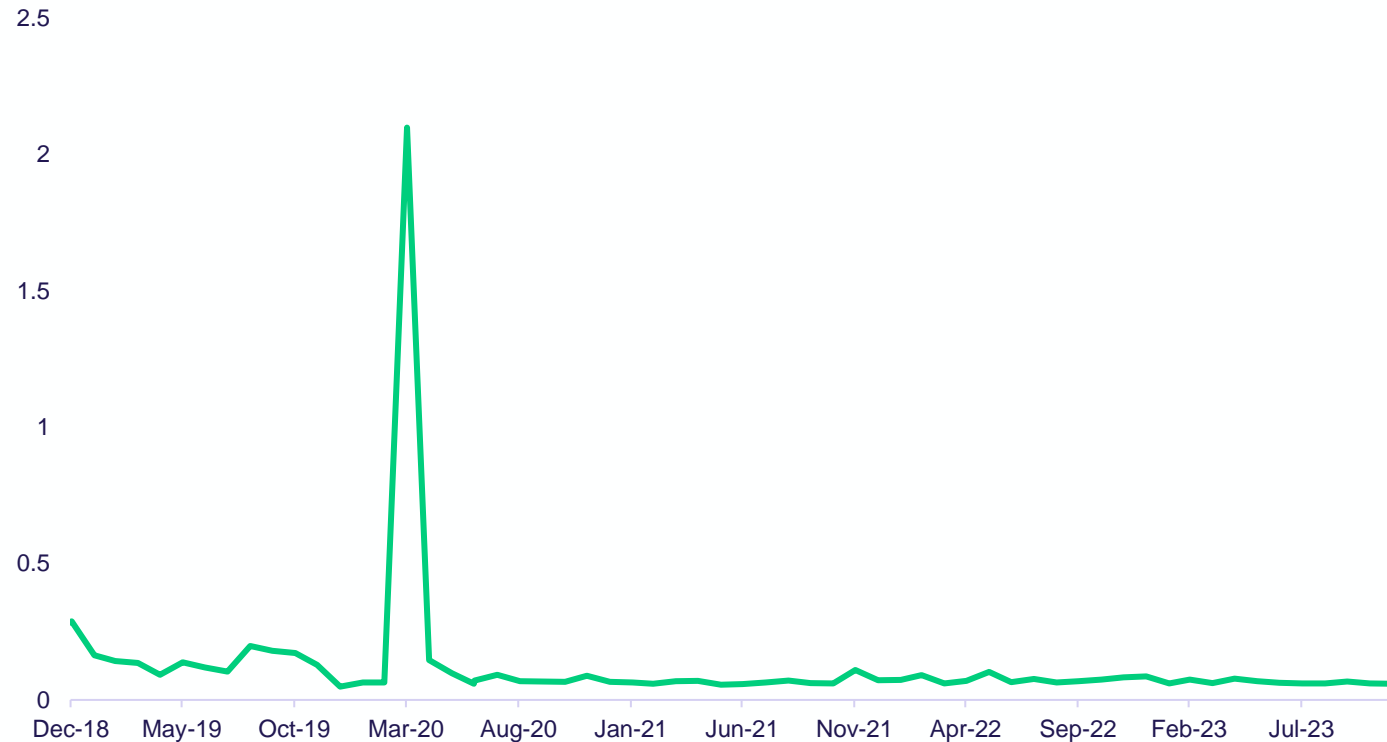


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A Path to Liquidity: Improve VSTOXX® Futures Orderbook

Order book spread improvements

VSTOXX Futures - Monthly Bid/Ask Spread Average



VSTOXX Futures Orderbook May 2023

Contract	CBQty	CBid	CAsk	CAQty
FVS Jul21	53	19.90	19.95	180
FVS Aug21	105	20.95	21.00	40
FVS Sep21	13	21.45	21.50	25
FVS Oct21	13	21.15	21.35	31
FVS Nov21	200	20.90	21.20	1
FVS Dec21	200	20.65	21.20	50
FVS Jan22	64	21.25	21.80	50
FVS Feb22	100	20.00		
FVS SPD Jul21 Aug21	63	-1.10	-1.05	17
FVS SPD Jul21 Sep21	25	-1.60	-1.50	13
FVS SPD Jul21 Oct21	6	-1.45	-1.15	163
FVS SPD Jul21 Nov21	53	-1.55	-0.95	163
FVS SPD Jul21 Dec21	53	-1.40	-0.70	163
FVS SPD Jul21 Jan22	50	-1.90	-1.25	50
FVS SPD Jul21 Feb22			-0.05	100
FVS SPD Aug21 Sep21	34	-0.55	-0.45	48
FVS SPD Aug21 Oct21	6	-0.40	-0.10	40
FVS SPD Aug21 Nov21	88	-0.50	0.10	40
FVS SPD Aug21 Dec21	88	-0.35	0.35	40
FVS SPD Aug21 Jan22	50	-0.85	-0.20	40
FVS SPD Aug21 Feb22			1.00	40

- Bid/Ask spread on VSTOXX futures narrowed by 49% in 2021 compared to 2020 due to the recovery of normal trading levels prior to the Mar 2020 Covid outbreak; **€0.0660 vs €0.2431**
- Front months futures are usually quoted **0.05** to **0.1** points wide

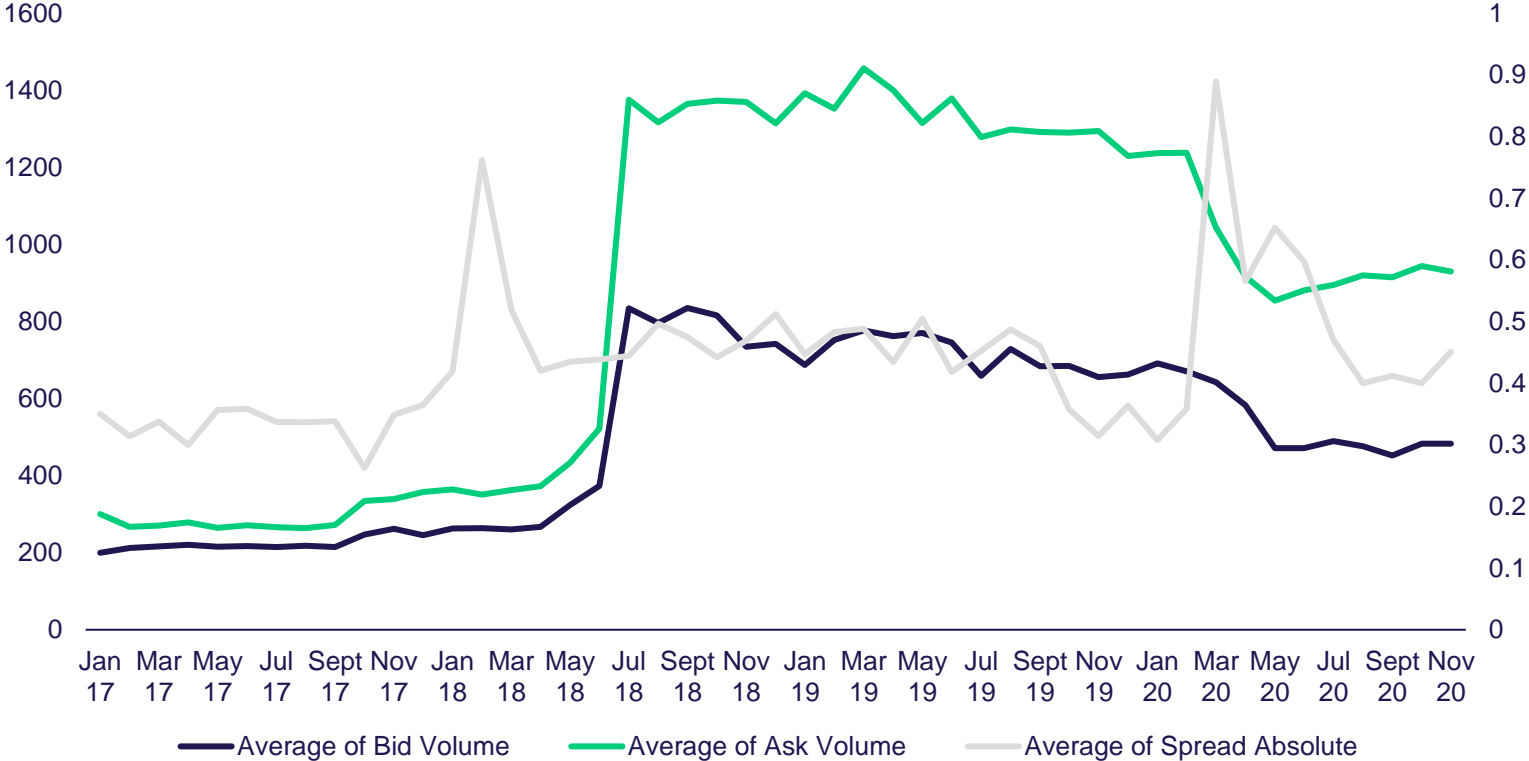
Open Options on VSTOXX® Futures to US participants

Listing options on futures”	<ul style="list-style-type: none"> Current OVS2 underlying is the VSTOXX® index, new OVS2 underlying is the future on VSTOXX® index
American-style	<ul style="list-style-type: none"> Option will be American style and could be exercised at any time <ul style="list-style-type: none"> Early exercise risk is considered extremely low since there are no dividend payments
Settlement Process	<ul style="list-style-type: none"> The settlement would change from “cash” to “physical” <ul style="list-style-type: none"> The underlying future expiring on the same day While the option will be physically delivered with the future, the future itself is cash settled. On the expiration day of both the option and its underlying future both products will expire in the following sequence: <ul style="list-style-type: none"> 11:30 a.m – 12p.m. (CET) Determination of the final settlement price of the underlying index Noon Expiration of options and futures Afternoon Manual exercise of the options on VSTOXX® futures Night batch Delivery of exercised options: creation of futures positions Night batch Cash settlement of future positions
Expiration	<ul style="list-style-type: none"> The expiration process will work as follow: Normal Exercise: The exercise of an option on the OVS2 contract results in the creation of a corresponding position in the VSTOXX® Futures for the option buyer as well as the seller to whom the exercise is assigned. The position is established during the night batch of the exercise day, and is based on the agreed exercise price. An option can be exercised up to the end of the Post-Trading Full Period (20:30 CET) on any exchange day <ul style="list-style-type: none"> Last Trading Day: Close of trading in the expiring option series on the last trading day is at 12:00 CET Expiration: An option can be exercised on the last trading day until 20:30 CET

Options on VSTOXX® Futures Liquidity

Increased order book liquidity and tighten spreads

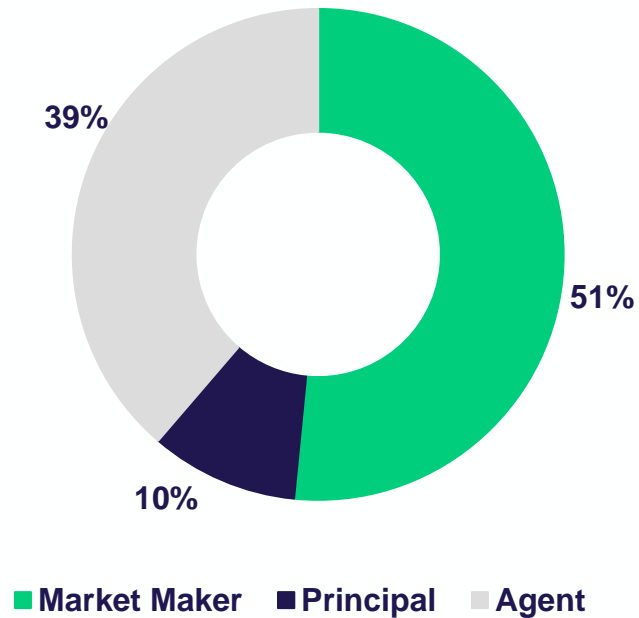
- With the phasing out of the cash settled VSTOXX options in 2017, we increased the minimum quote size for Market Makers in the remaining Option on VSTOXX futures (OVS2)
- Thereafter, some of the Market Makers voluntarily increased their size even further
- It is interesting that Market Makers seem to have a preference to sell OVS2



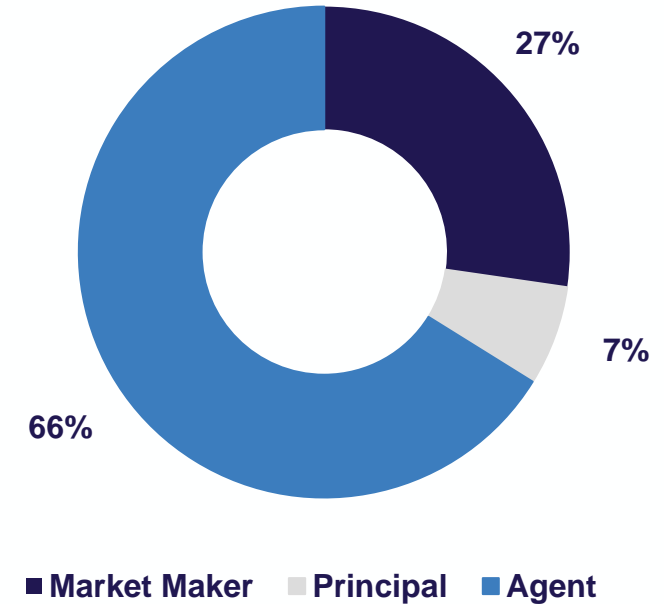
VSTOXX® - Volumes By Account Type

Mixed and healthy account structure

FVS Account Role - YTM 2023



OVS2 Account Role - YTM 2023



Agenda

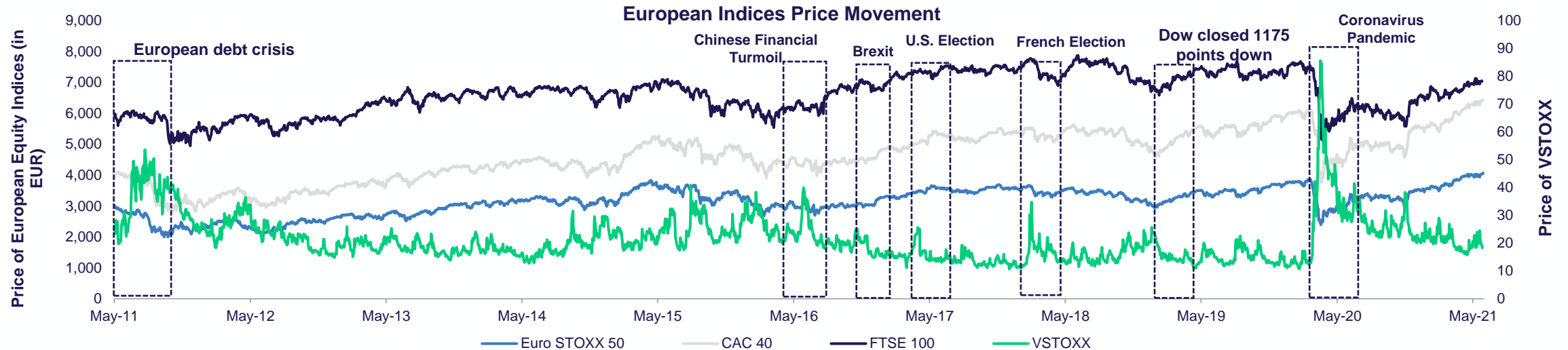
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VSTOXX® The European Volatility Benchmark

The VSTOXX® Futures and Options for the Traditional Investor

Hedge your exposure

- Hedge your exposure to equity, credit and options
- Volatility indexes have **negative correlation** with equity markets and can hedge a long-only portfolio and improve the efficient frontier
- VSTOXX® offers a cost efficient way to implement a tail risk hedge



Correlations*	EURO STOXX® 50	S&P 500	CAC 40	FTSE 100
VSTOXX® Index	-0.8229	-0.6701	-0.7790	-0.6908
VIX® Index	-0.8149	-0.6602	-0.7937	-0.7770
VCAC	-0.2394	-0.0675	-0.3306	-0.3492

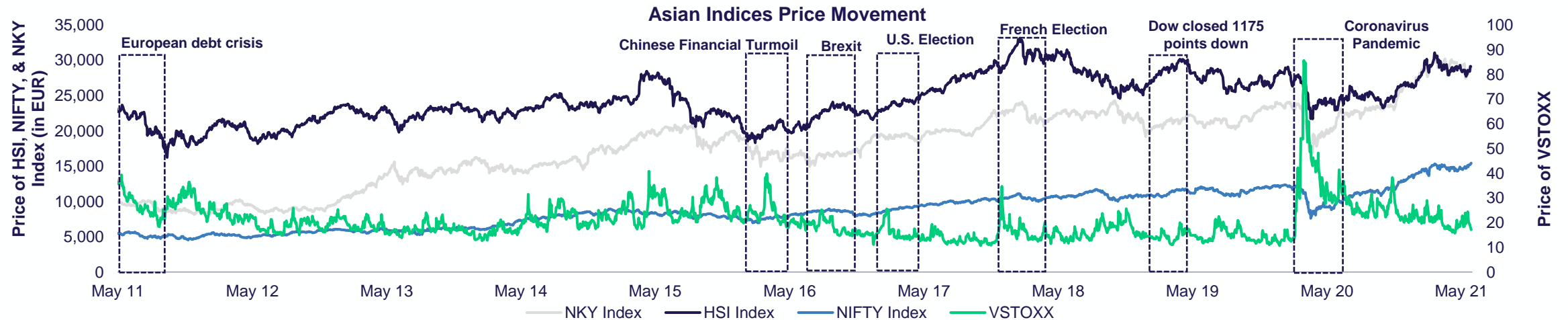
January 1, 2020 – May 31, 2021

VSTOXX® & Asian Indices

The VSTOXX® Futures and Options for the Traditional Investor

Hedge your exposure

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Correlations*	EURO STOXX® 50	S&P 500	HSI	NIKKEI 225
VSTOXX® Index	-0.8229	-0.6701	-0.4782	-0.5625
VIX® Index	-0.8149	-0.6602	-0.5130	-0.5519
VHSI Index	-0.6493	-0.6154	-0.5978	-0.6095
NIKKEI Volatility Index	-0.6282	-0.6050	-0.5611	-0.6001

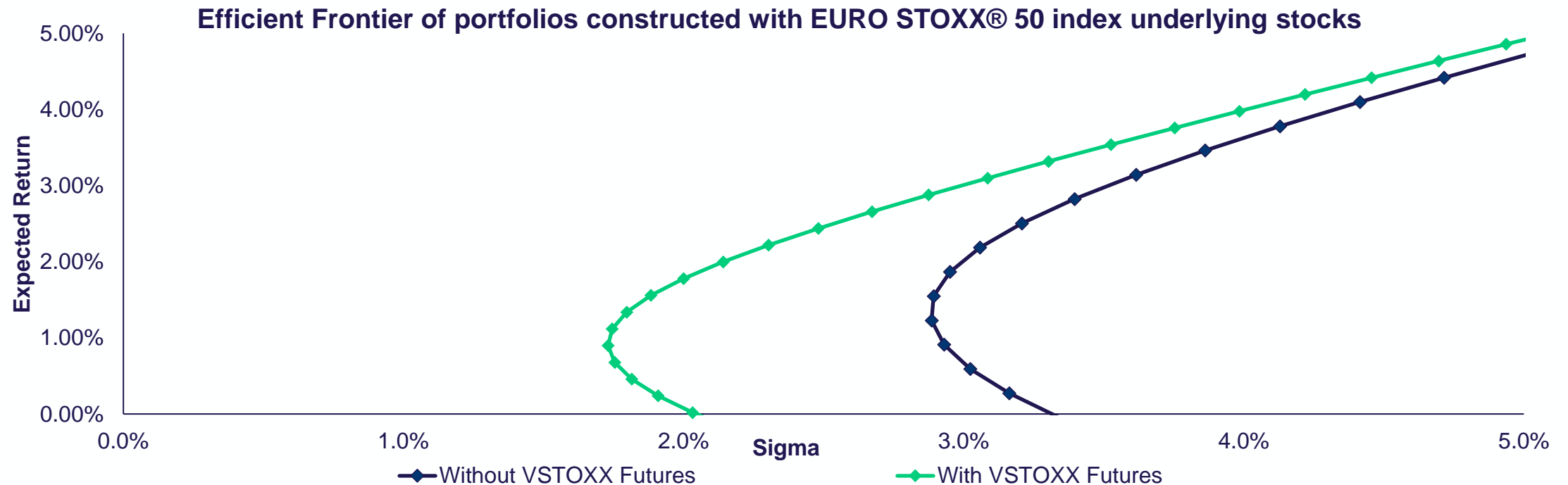
January 1, 2020 – May 31, 2021

VSTOXX® The European Volatility Benchmark

The VSTOXX® Futures and Options for the Traditional Investor

Inclusion of VSTOXX® futures in the portfolio can construct a better efficient frontier

- The graph shows a set of optimal portfolios that offers the highest expected return for a defined level of risk or the lowest risk for a given level of expected return
- Sigma of the minimum variance set is effectively reduced from 1.9% to 1.1%, while retaining the same level of return*
- Allocation to VSTOXX® futures allows an investor to generate portfolios with more attractive risk and return combinations



*Calculation based on monthly price changes of all 50 underlying stocks of EURO STOXX 50 Index and front month VSTOXX Futures from July 2009 until January 31, 2020

VSTOXX® The European Volatility Benchmark (1/2)

The VSTOXX® futures and options for the Relative Value Trader

Relative Value Trading opportunities

Explore spreads between European and Non European Indices

VSTOXX® and VIX use similar index calculation , however the VSTOXX® Index fundamentally valued at a premium to VIX

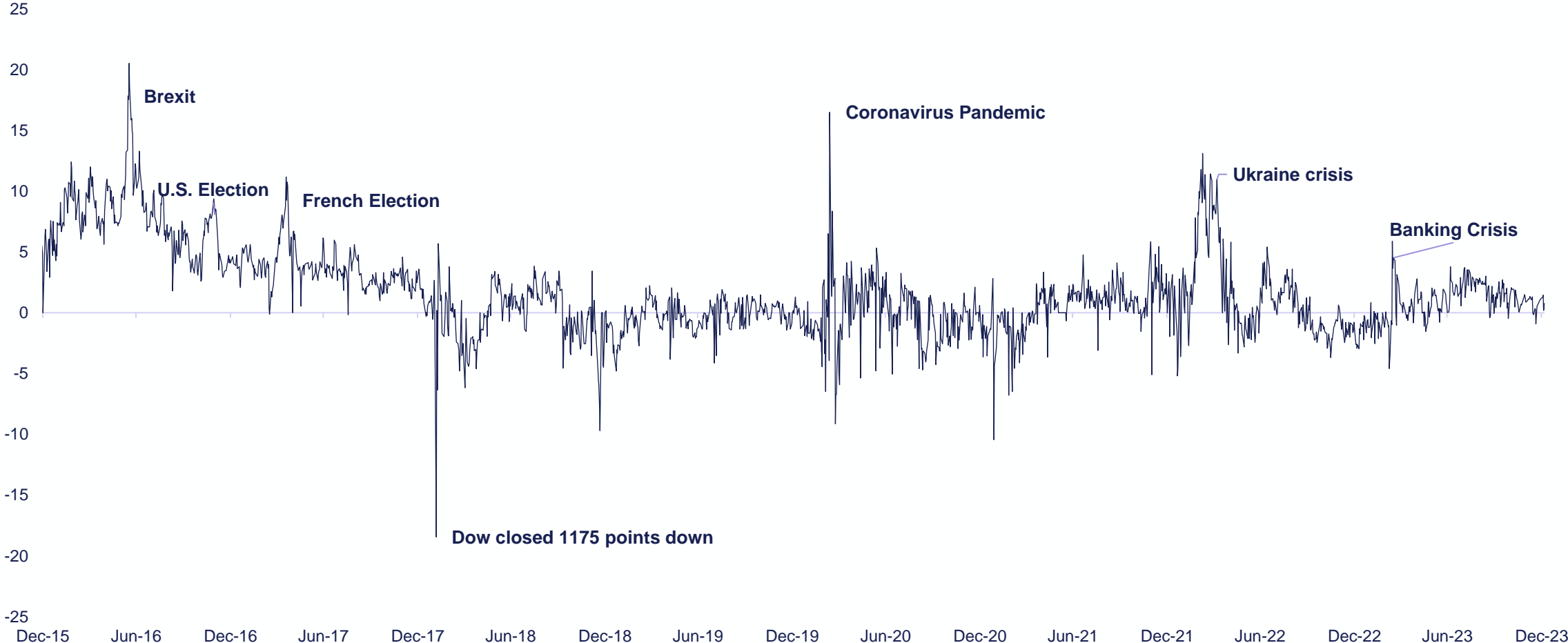
- More concentrated: Based on EUROSTOXX 50®: an index of 50 stocks as comparable to S&P 500 an index of 500 stocks.
- More volatile constituents: ~25% of the EUROSTOXX 50® is financials as compared to ~17.5% of the S&P 500

VSTOXX®/VIX spread is volatile and mean-reverting, and breaks down especially during times of Euro and US specific crisis

- Since Jan 2014, the spread has averaged 3.80 points (VSTOXX® over the VIX)
- In 2016 the average spread jumped to 8.02 points due to European-specific volatility
- In June 2015, the spread went to 13 due to the Greek Crisis then went below 1.0 in August 2015 when US equities tumbled
- In June 2016, the spread went over 20 due to the Brexit

VSTOXX® The European Volatility Benchmark (2/2)

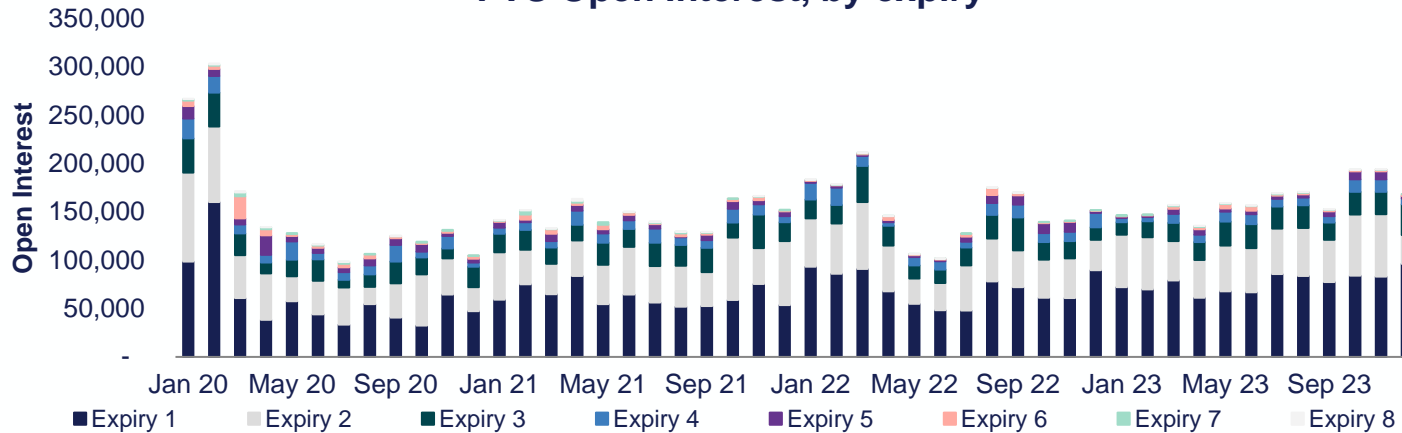
The VSTOXX® futures and options for the Relative Value Trader



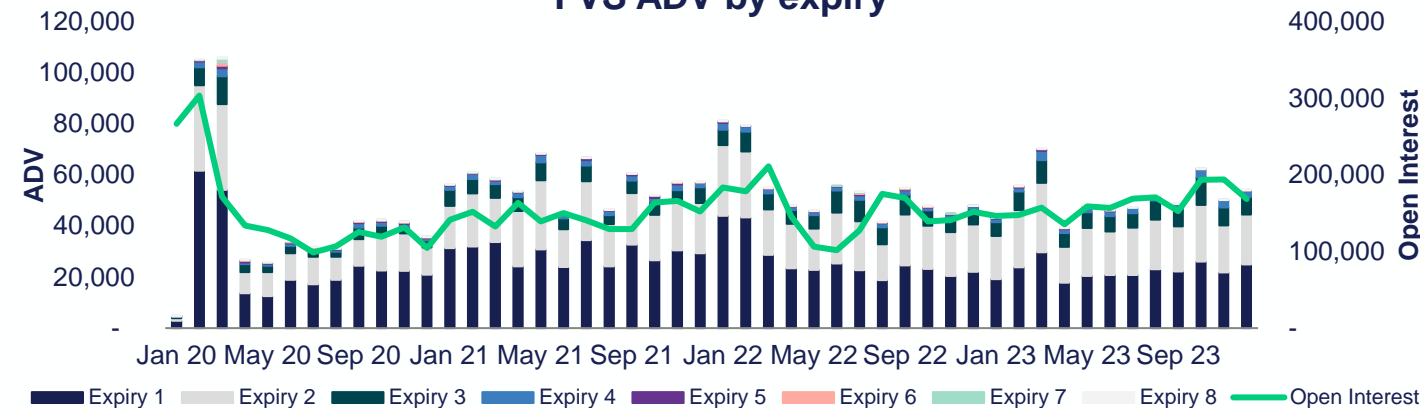
VSTOXX® The European Volatility Benchmark

The VSTOXX® futures and options for the Term Structure Trader

FVS Open Interest, by expiry



FVS ADV by expiry

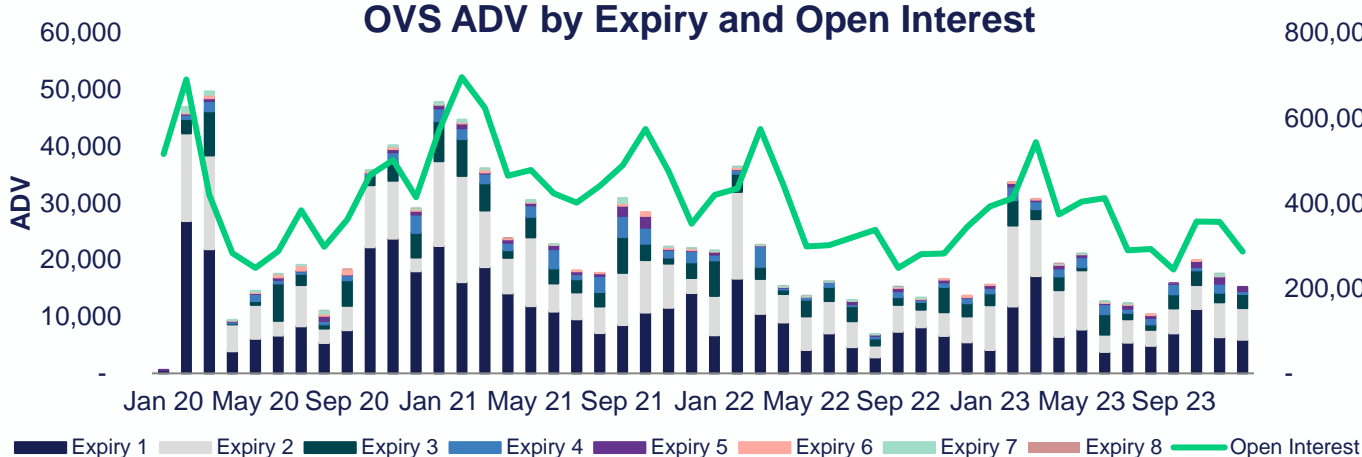


Term Structure Trading opportunities

- Volatility is a depleting asset (theta) and therefore the cost to roll a position is high. Therefore, hedgers use calendar spreads to finance their positions and to hedge longer dated risk in their equity portfolios. As a result, the VSTOXX® term structure has open interest and volume throughout all eight expiries.
- This has appealed to term structure traders, like short term interest rate traders, who are well versed in calendar spread market making.
- VSTOXX® term structure moves from contango to backwardation, primarily driven by front month movement. VSTOXX® term structure has been in contango 70% of the time since 2011
- With the new T7, Eurex implemented a fully integrated calendar spread trading for term structure traders

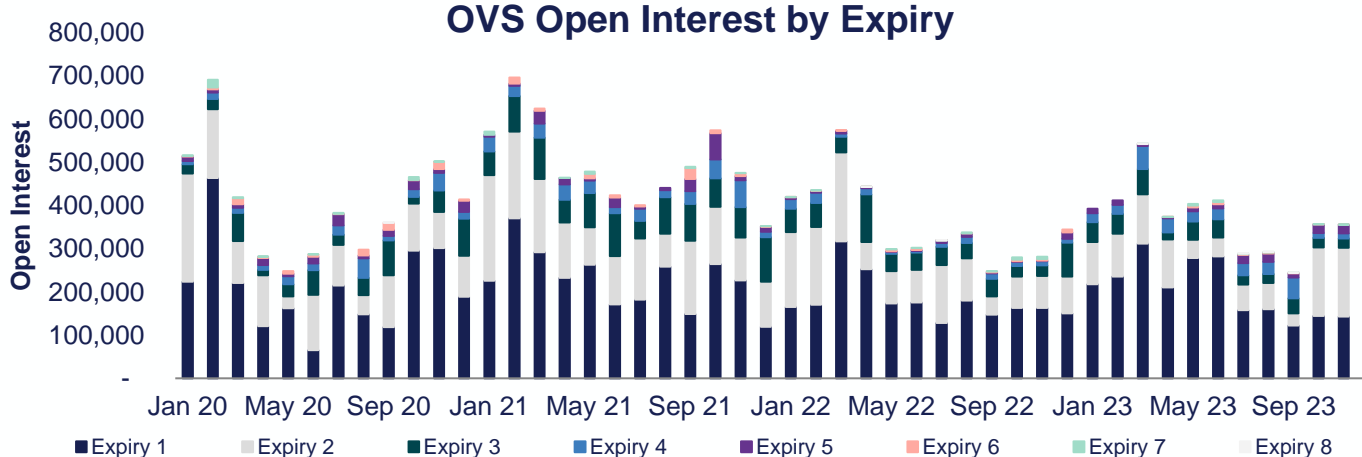
VSTOXX® The European Volatility Benchmark

The VSTOXX® futures and options for the Term Structure Trader



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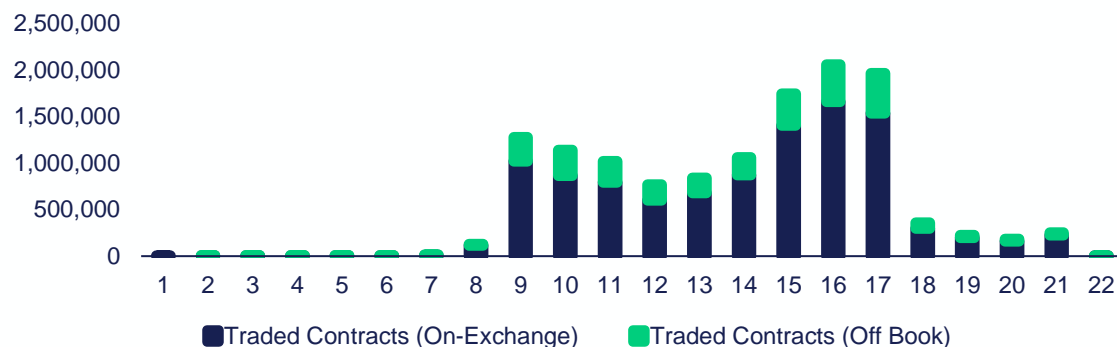
VSTOXX® – Volume by Hour and Trade Size

In both options and futures on VSTOXX, US hours (14:00 Hours CET onwards) constitute majority of the trading day volumes (see table).

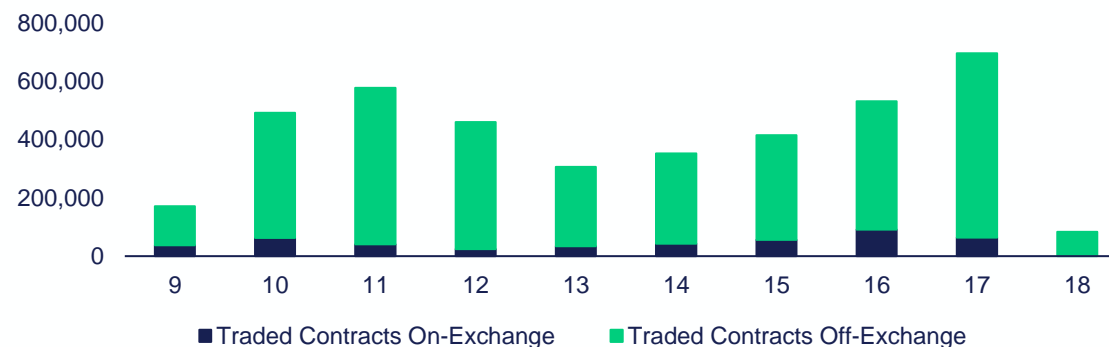
Product	Year	% Volume During US Hours	Average Notional Trade Size - Orderbook	Average Notional Trade Size - Offbook	Average Notional Trade Size - Total	Average Trade Size (Contract) - Orderbook	Average Trade Size (Contract) - Offbook	Average Trade Size (Contract) - Total
FVS	2023	59.97%	10,835	1,671,166	11,651	6	871	6
	2022	61.38%	11,943	2,065,455	12,564	4	762	5
	2021	64.41%	13,785	1,348,361	14,578	6	630	7
	2020	60.24%	19,809	2,297,914	21,214	7	956	8
OVS2	2023	51.82%	279,625	5,449,087	1,470,843	81	2,237	578
	2022	59.38%	263,296	8,495,789	2,040,678	71	2,279	548
	2021	59.38%	358,529	5,865,702	2,037,102	113	2,090	716
	2020	62.52%	567,671	6,816,794	1,637,405	144	2,401	530

Charts below depict the trend of hourly volumes in 2023 for FVS and OVS2. Increase in volumes is evident during US hours.

**VSTOXX Futures - 2023
Hourly Volumes By Trade Type**



**VSTOXX Options – 2023
Hourly Volumes By Trade Type**



Hours are depicted in Central European Time

2021 VSTOXX® Futures Liquidity Provision & Revenue Share Scheme

Duration	1 January 2021 until 31 December 2021
Minimum contract size	Scheme 1: 30 contracts / Scheme 2: 100 contracts (50 for Expiry 7-8) / Scheme 3: 50 contracts
Maximum spread	<p>Scheme 1: Entry Level Liquidity Provider Scheme Contract months 1-3: 0.30 volatility index points for bids up to 20 index points. 2% for bids greater than 20, 3% for bids greater than 30, 6% for bids greater than 40 and 9% for bids greater than 60. Contract months 5-8: 0.45 volatility index points for bids up to 20 index points. 3% for bids greater than 20, 5% for bids greater than 30, 9% for bids greater than 40 and 14% for bids greater than 60.</p> <p>Scheme 2: EU Hours Revenue Share Contract months 1-4: 0.30 volatility index points for bids up to 20 index points. 2% for bids greater than 20, 3% for bids greater than 30, 6% for bids greater than 40 and 9% for bids greater than 60. Contract months 5-8: 0.45 volatility index points for bids up to 20 index points. 3% for bids greater than 20, 5% for bids greater than 30, 9% for bids greater than 40 and 14% for bids greater than 60.</p> <p>Scheme 3: US Liquidity Provider Scheme Contract months 1-4: 0.40 volatility index points for bids up to 20 index points. 3% for bids greater than 20, 4% for bids greater than 30, 8% for bids greater than 40 and 11% for bids greater than 60. Contract months 5-8: 0.60 volatility index points for bids up to 20 index points. 5% for bids greater than 20, 6% for bids greater than 30, 12% for bids greater than 40 and 17% for bids greater than 60.</p>
Required coverage	<p>Scheme 1&2 75% of the total trading period on a monthly average between 09:00 and 17:30 CET</p> <p>Scheme 3: 75% of the total trading period on a monthly average between 14:00 and 22:00 CET</p>
Maturity range	All eight maturities must be covered.
Incentive	<p>All schemes: 100% free rebate for trades on the M-account from 1 January 2021 until 31 December 2021, for fulfilling monthly obligations.</p> <p>For scheme 2: Up to 30% of the net revenues will be distributed among all participants that fulfil the Basis Block requirements on a monthly. The market share in trading volumes in the M-account for each fulfilling Liquidity Provider will be rounded to two decimals and multiplied by the revenue sharing pool.</p>

2021 Options on VSTOXX® Futures Market-Making & Revenue Share

Products included	OVS2	
Duration	1 January 2021 until 31 December 2021	
Minimum Quote Size	Expiry 1-3	750 contracts
	Expiry 4-6	200 contracts
Maximum Spread for Expiries 1-4	Bid up to 2	max. spread 0.30 points
	Bids from 2 to 20	15% of bid price
	Bid > 20	max. spread 3 points
Maximum Spread for Expiries 5-6	Bid up to 2	max. spread 0.40 points
	Bids from 2 to 20	20% of bid price
	Bid > 20	max. spread 4 points
Required Coverage	80% of the total trading period on a monthly average for calls and puts in five out of eleven strikes around the current index level. Asymmetric quotation is allowed.	
Expiry Range	The first six expiration months.	
Incentive	100% fee rebate for trades on M-account in OVS2, for fulfilling monthly obligations. All fulfilling Liquidity Providers participate, ranked according to their share of trading volume in M-accounts (order book and off-book) of all fulfilling members. The market share in trading volume in the M-accounts of each Liquidity Provider will be rounded to two decimals and multiplied by the revenue sharing pool.	

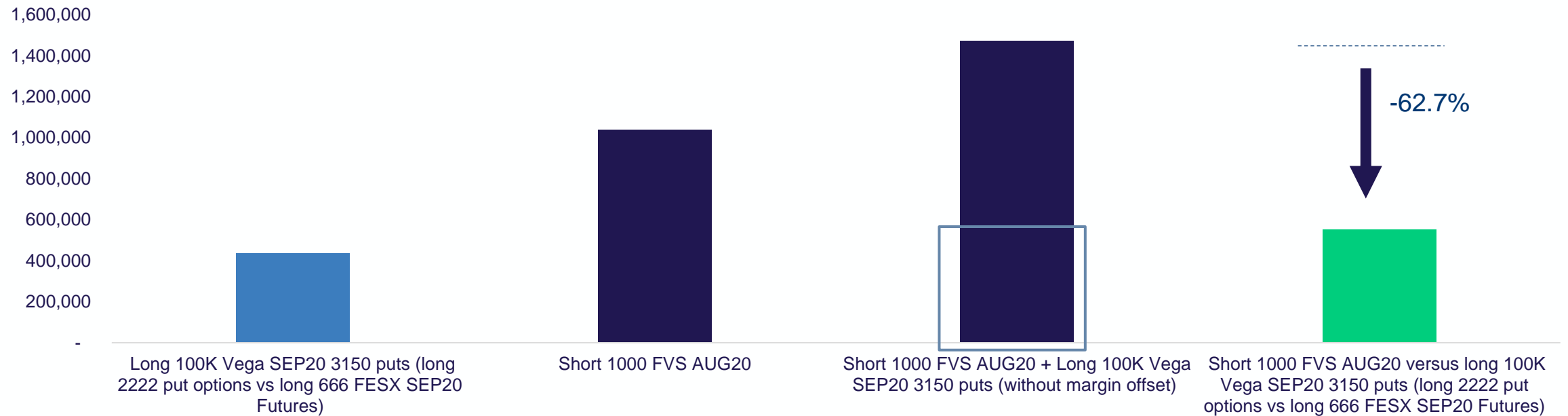
Agenda

- 1** The VSTOXX® Index & Eurex's Product Offering
- 2** Milestone Development
- 3** A Path to Liquidity
- 4** Hedging, Relative Value, Market Making, Retail
- 5** **Efficient Margining**
- 6** Appendix

The effects of the Eurex portfolio margin system (PRISMA)

Positive margin offsets based on a diversified portfolio example comprising Short 1000 FVS AUG20 and Long 100K Vega SEP20 3150 puts

Without Prisma margin offset	With Prisma margin offset	Relative Margin Change
1,472,642.06	549,377.65	-62.7%



Thank you!

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