



**THE
EXCHANGE
FOR THE
WORLD
STAGESM**

VARIANCE FUTURES

New Contract Design Proposal: Subject to Change

Last updated March 6, 2024

Outline

- Overview: 3
- Previous Contract Challenges: 4
- New Contract Features: 5-6
- Margin Treatment: 7
- New Contract Pros/Cons: 8
- New Variance Contract Design: 9
- Final Settlement Value: 10
- Daily Settlement Prices: 11
- Trading in Variance Units: 12-16
- Cboe.com Online Calculator: 17
- Appendix - Example Contract History: 18-23
- Appendix - Market Disruption Example: 24-25

Overview

- Cboe Futures Exchange, LLC (CFE) previously listed a Variance Futures contract designed as a cleared equivalent of OTC Variance Swaps.
- The futures contract was delisted in 2022.
- As a result of Uncleared Margin Rules (UMR) Phase 6, effective September 2022, customer interest in a new Variance Futures contract has been received.
- CFE plans to relaunch a Variance Futures contract that leverages experience from the prior contract and feedback from market participants.
- An alternative product design and ecosystem is presented in this document.

This document is a high-level overview of what is currently contemplated which was prepared in order to solicit input from market participants. The information included is subject to change and to more detailed provisions that would be put in place in connection with the planned relaunch of the product. Additionally, the planned relaunch of the product remains subject to regulatory review.

Previous Contract Challenges

- The previous contract traded in volatility points (price) and vega (size) but cleared in Variance Units.
 - A TAS-like interface to the product was required that produced an initial proxy fill report to the user to confirm a trade.
 - At the end of the trading day when the S&P 500 index closing value was established, price and size were converted to a futures price and number of variance units, trades were cleared in variance units, and a second final fill report confirming the translated cleared price and size in variance units was sent to the user.
 - The result was custom order entry protocol (FIX/BOE) functionality that required user-side system customization that involved both price and size restatement.
 - Variance Futures Stub Positions, that trade in Variance Units, were necessary to enable exit of a position prior to expiration, which further complicated the interface, which created an additional impediment to trading.
- Accumulated Return on Modified Variation Margin (ARMVM) in product formulation made it difficult for users to exactly replicate Variance Units and added complexity to disruption event considerations.

New Contract Features

- The planned new Variance Futures contract will quote and trade in variance units
 - Trades in variance units clear immediately with standard execution report, with no post-trade restatements, removing the need for custom trade processing and OMS customization.
 - Trading in variance units, rather than vega, eliminates the need for stub futures as a position is exactly offset by trading the held number of variance units.
- Simplified product analytics
 - ARMVM, discounting, initial strike and arbitrary constant from the previous contract are no longer in the new contract.
 - Final settlement price is the variance of a sequence of S&P 500 index values.
- Contract attributes
 - Contract size is 1 Variance Unit
 - Block and ECRP trades will be supported.
 - TAS orders and Exchange listed calendar spreads will not be supported

New Contract Features (Cont)

➤ Contract listing schedule

- A new variance futures contract is listed on the day each new standard AM settled SPX is listed.
- The expiration date of the variance futures contract is the same as the expiration date of the associated SPX contract
- The number of expected returns is established at the time of listing based on the number of trading days between the listing date and the expiration date of the SPX and variance futures contracts.
- The final settlement value of variance futures contract is the realized variance of the S&P 500 index the date of listing to the expiration date, where the final day of realized variance uses the S&P 500 special opening quote (SOQ) used to settle the associated SPX contract.

➤ Market disruption dates

- The number of daily variance values accrued into the final settlement value remain unchanged in the event of market disruption events. Zero daily variance accrues for each market disruption date. The accrued variance for the non-disruption day following one or more market disruption dates uses the S&P 500 index value from the non-disruption day preceding the one or more market disruption dates.

Margin Treatment

Expiration	Listing Date	Number Expected Returns	Symbol	Implied Vol	Annualized Time Weighted IV	Annualized Time Weighted RV	Futures Price	Margin by Vega Notional	Margin as of April 2022
20-Oct-2023	15-Sep-2022	288	VAV23	17.01	17.19	274.59	291.78	6-10 σ	16-47 σ
17-Nov-2023	20-Oct-2022	283	VAX23	17.14	38.69	218.34	257.04		
15-Dec-2023	17-Dec-2020	783	VAZ23	17.83	30.12	288.79	318.91		
19-Jan-2024	17-Sep-2022	351	VAF24	18.40	79.54	224.31	303.85	4-6 σ	4-6 σ
16-Feb-2024	19-Jan-2023	283	VAG24	19.01	126.01	112.03	238.04		
15-Mar-2024	15-Dec-2022	328	VAH24	19.60	142.61	115.19	257.80		
19-Apr-2024	16-Mar-2023	288	VAJ24	20.24	203.44	70.37	273.81		
17-May-2024	20-Apr-2023	283	VAK24	20.69	245.28	58.74	304.02		
21-Jun-2024	16-Jun-2022	528	VAM24	21.12	165.42	204.68	370.10	2-3 σ	2-3 σ
19-Jul-2024	15-Jun-2023	288	VAN24	21.67	336.48	33.70	370.18		
16-Aug-2024	20-Jul-2023	283	VAQ24	21.97	383.12	26.89	410.01		
20-Sep-2024	15-Jun-2023	333	VAU24	21.91	362.65	29.12	391.77		

Source: Cboe

Improved margin treatment from OCC

- OCC cleared - margin requirements won't be as low as typical pre-UMR / pre-2020 levels. However, 2022 improvements to STANS support cross-margining between SPX options, VIX derivatives and Variance futures for eligible clearing participants.
- SEC Order Granting Approval of Proposed Rule Change Concerning The Options Clearing Corporation's Margin Methodology for Incorporating Variations in Implied Volatility Jul 19, 2022. See [SEC Release Number 34-95319](#)

This estimated margin information is a brief summary and should only serve as a supplement to careful review of relevant CFE rules, OCC rules, Commodity Exchange Act (CEA) provisions, and CEA regulations dealing with margin requirements. The estimated margin information here is for hypothetical contracts, is as of the publication date, and subject to change. This information should be used solely for reference and is not intended to be an all-encompassing description of applicable margin requirements. Brokerage firms may require customers to post higher margins than required minimums

New Contract Potential Pros / Cons

- Trading price in variance units may be less intuitive than volatility points.
- Trading size in variance units rather than vega units is different from standard variance swap OTC contracts and other variance futures designs.
- Immediate clearing in variance units introduces variability in the exact vega position established at the end of the day of entry.
- Immediate clearing introduces entry day PNL, but also presents an entry day trading opportunity.
- Analogous to trading volatility via hedged options or VIX futures, exchange fees are the same entering and exiting a position (i.e., the number of contracts, where 1 contract = 1 variance unit, is the same on entry and exit). Also analogously, the number of contracts traded to establish a specified vega position increases with decreasing time to expiration.

New Variance Contract Design

- The following slides present the following aspects of the new variance futures contract design and ecosystem for trading.
 - Final settlement value
 - Daily settlement prices
 - Trading in variance units with example
 - Cboe.com online calculator

Final Settlement Value

$$F_s = \frac{252}{N} \left(\sum_{i=0}^N R_i^2 \right) \quad (1)$$

$$R_0 = 0$$

$$R_i = 100 * \ln \left(\frac{P_{set,i}}{P_{set,i-1}} \right) \quad i = 1, 2, \dots, N - 1$$

$$R_N = 100 * \ln \left(\frac{P_{soq,N}}{P_{set,N-1}} \right)$$

Final return (R_N) uses Special Opening quote of the S&P 500 index vs the prior day end of day index settlement price. Other days use consecutive end of day index settlement prices.

Daily Settlement Prices

- The daily settlement price of a variance futures contract is generally established by the average of the bid and the offer from the last best two-sided market in that contract during the applicable business day which simultaneously includes both a pending bid with a non-zero value and a pending offer with a non-zero value.
- End of day variance futures values reflect realized and forward implied variance.

$$F_n = \frac{252}{N} \left(\underbrace{\sum_{i=0}^n R_i^2}_{\text{REALIZED}} + \underbrace{\sigma_n^2 \frac{N-n}{252}}_{\text{IMPLIED}} \right) \quad (2)$$

- REALIZED is the accrued daily variance of the S&P 500 index
- IMPLIED is an observed value based on the daily settlement price of the corresponding variance future and accrued daily variance observed to that date.

Trading in Variance Units

- A trader of variance generally seeks to enter a position with a target vega exposure.
- The vega exposure of one variance unit is the following:

$$V_n = \frac{\partial F_n}{\partial \sigma_n} = 2\sigma_n \frac{N - n}{N} \quad (3)$$

- The number (size) of variance units to trade depends on the forward implied variance and the remaining time to expiration in the futures contract.
- The intraday price being quoted in the lit market is a function of the prior date realized variance and estimates of the current date index settlement value and the forward implied variance (vol).

$$F_* = \frac{252}{N} \left(\underbrace{\sum_{i=0}^{n-1} R_i^2}_{\text{PRIOR DAY REALIZED}} + \underbrace{\left(100 * \ln \left(\frac{P_*}{P_{n-1}} \right) \right)^2}_{\text{CURRENT DAY REALIZED ESTIMATE}} + \underbrace{\sigma_*^2 \frac{N - n}{252}}_{\text{IMPLIED ESTIMATE}} \right) \quad (4)$$

Trading in Variance Units - Example

Consider a hypothetical 20-day duration variance futures contract.

The following is an example contract history with daily index settlement prices, σ_n implied by the end of variance swap, estimated futures contract daily settlement prices and end of day single contract vega.

Table 1 – Variance futures contract settlement value history

Date	n	N	Idx(n)	Idx(n-1)	DayVar	DayVarSum	EodVarSwap	EstDsv	EodContVega
2022-02-16	0	20	0	0	0.0000	0.0000	27.83	774.5089	55.66
2022-02-17	1	20	4380.26	4475.01	4.5798	4.5798	29.38	877.7309	55.82
2022-02-18	2	20	4348.87	4380.26	0.5173	5.0971	29.37	840.5603	52.87
2022-02-22	3	20	4304.76	4348.87	1.0393	6.1364	29.30	807.0349	49.81
2022-02-23	4	20	4225.50	4304.76	3.4536	9.5900	29.90	836.0414	47.84
2022-02-24	5	20	4288.70	4225.50	2.2041	11.7940	29.23	789.3992	43.85
2022-02-25	6	20	4384.65	4288.70	4.8957	16.6897	28.35	772.8956	39.69
2022-02-28	7	20	4373.94	4384.65	0.0598	16.7495	29.12	762.2268	37.86
2022-03-01	8	20	4306.26	4373.94	2.4319	19.1813	31.36	831.7547	37.63
2022-03-02	9	20	4386.54	4306.26	3.4118	22.5931	30.59	799.3347	33.65
2022-03-03	10	20	4363.49	4386.54	0.2776	22.8707	30.56	755.1275	30.56
2022-03-04	11	20	4328.87	4363.49	0.6345	23.5052	31.58	744.9490	28.42
2022-03-07	12	20	4201.09	4328.87	8.9775	32.4827	33.40	855.5065	26.72
2022-03-08	13	20	4170.70	4201.09	0.5271	33.0098	33.37	805.6688	23.36
2022-03-09	14	20	4277.88	4170.70	6.4382	39.4481	32.35	811.0024	19.41
2022-03-10	15	20	4259.52	4277.88	0.1850	39.6331	31.95	754.5771	15.98
2022-03-11	16	20	4204.31	4259.52	1.7021	41.3351	32.32	729.7389	12.93
2022-03-14	17	20	4173.11	4204.31	0.5548	41.8899	33.04	691.5594	9.91
2022-03-15	18	20	4262.45	4173.11	4.4870	46.3769	32.01	686.8134	6.40
2022-03-16	19	20	4357.86	4262.45	4.9005	51.2774	30.37	692.2122	3.04
2022-03-17	20	20	4345.11	4357.86	0.0859	51.3633	0.00	647.1770	0.00

Source: Cboe

Trading in Variance Units – Example (cont)

Trader seeks to enter position on 5th day of listed contract (n=5).

Equation (4) is used to create a grid of estimated settlement values as a of the current date index settlement price and volatility. Green corresponds to prior day and blue to current day index and implied variance (vol).

Table 2 – Daily futures settlement value grid (n=5)

VOL	28.25	28.50	28.75	29.00	29.23	29.25	29.50	29.75	29.90	30.00	30.25	30.50	30.75
VEGA	42.38	42.75	43.13	43.50	43.85	43.88	44.25	44.63	44.85	45.00	45.38	45.75	46.13
4025	1017.14	1027.78	1038.52	1049.35	1059.39	1060.27	1071.28	1082.39	1089.10	1093.60	1104.89	1116.28	1127.77
4050	946.12	956.76	967.49	978.32	988.37	989.24	1000.26	1011.37	1018.08	1022.57	1033.87	1045.26	1056.74
4075	885.11	895.75	906.48	917.31	927.35	928.23	939.25	950.36	957.07	961.56	972.86	984.25	995.73
4100	833.92	844.56	855.30	866.12	876.17	877.05	888.06	899.17	905.88	910.37	921.67	933.06	944.55
4125	792.39	803.03	813.76	824.59	834.64	835.51	846.53	857.64	864.35	868.84	880.14	891.53	903.01
4150	760.34	770.98	781.71	792.54	802.58	803.46	814.48	825.59	832.30	836.79	848.09	859.48	870.96
4175	737.59	748.24	758.97	769.80	779.84	780.72	791.74	802.84	809.56	814.05	825.34	836.74	848.22
4200	724.00	734.64	745.37	756.20	766.24	767.12	778.14	789.25	795.96	800.45	811.75	823.14	834.62
4225	719.38	730.02	740.76	751.59	761.63	762.51	773.52	784.63	791.34	795.84	807.13	818.52	830.01
4225.50	719.38	730.02	740.76	751.58	761.63	762.51	773.52	784.63	791.34	795.83	807.13	818.52	830.01
4250	723.59	734.23	744.97	755.79	765.84	766.72	777.73	788.84	795.55	800.04	811.34	822.73	834.22
4275	736.47	747.11	757.85	768.67	778.72	779.60	790.61	801.72	808.43	812.92	824.22	835.61	847.10
4288.70	747.15	757.79	768.53	779.35	789.40	790.28	801.29	812.40	819.11	823.60	834.90	846.29	857.78
4300	757.87	768.51	779.24	790.07	800.12	800.99	812.01	823.12	829.83	834.32	845.62	857.01	868.49
4325	787.64	798.28	809.01	819.84	829.88	830.76	841.78	852.89	859.60	864.09	875.39	886.78	898.26
4350	825.63	836.27	847.00	857.83	867.87	868.75	879.77	890.88	897.59	902.08	913.38	924.77	936.25
4375	871.70	882.34	893.07	903.90	913.95	914.82	925.84	936.95	943.66	948.15	959.45	970.84	982.32
4400	925.71	936.36	947.09	957.92	967.96	968.84	979.86	990.96	997.68	1002.17	1013.46	1024.86	1036.34
4425	987.54	998.18	1008.91	1019.74	1029.78	1030.66	1041.68	1052.79	1059.50	1063.99	1075.29	1086.68	1098.16

Trading in Variance Units – Example (cont)

- Assume trader has view of current day volatility 29.50.
- Table 2 shows single contract vega of 44.25 corresponds to 29.50 vol 5 days into the listed contract (n=5).
- 22 contracts are needed to realized a total vega notional of 1,000.
- Trader bids and 795.00 for 22 contracts. Bid is hit. Trade clears 22 contracts at 795.00 futures price.
- Trader receives standard FIX Execution Report with LastShares(32) = 22 and LastPx(31) = 795.00
- Based on entry day end of day index (4,288.70) and end of day implied vol (29.33), trade realizes entry day PNL:

$$PNL = 22 * (789.40 - 795) = \$(123.20)$$

- Assume trader chooses to exit position 10 days later, 15 days into the life of the contract (n=15).
- Similar to the process at n=5, trader uses Equation (4) to create a settlement price grid at n=15 based on end of day index and implied variance (vol) levels (Table 3).

Trading in Variance Units – Example (cont)

Trader offers 800 intraday to exit 22 contracts based on an implied variance (vol) view of 32 and an intraday index price of 4,200. Offer is lifted. Trade clears 22 contracts at futures price 800.

Position is now flat and terminal trade PNL is the following:

$$PNL = 22 * (800 - 795) = \$110.00$$

Table 3 – Daily futures settlement value grid (n=15)

VOL	30.75	31.00	31.25	31.50	31.75	31.95	32.00	32.25	32.35	32.50	32.75	33.00	33.25
VEGA	15.38	15.50	15.63	15.75	15.88	15.98	16.00	16.13	16.18	16.25	16.38	16.50	16.63
4080	1016.06	1019.92	1023.81	1027.73	1031.68	1034.87	1035.67	1039.68	1041.30	1043.73	1047.81	1051.92	1056.06
4105	947.85	951.71	955.60	959.52	963.48	966.66	967.46	971.48	973.09	975.52	979.60	983.71	987.85
4130	889.38	893.24	897.13	901.05	905.00	908.19	908.99	913.00	914.62	917.05	921.13	925.24	929.38
4155	840.47	844.32	848.22	852.14	856.09	859.28	860.07	864.09	865.71	868.14	872.22	876.32	880.47
4180	800.94	804.80	808.69	812.61	816.57	819.75	820.55	824.57	826.18	828.61	832.69	836.80	840.94
4205	770.64	774.50	778.39	782.31	786.26	789.45	790.25	794.26	795.88	798.31	802.39	806.50	810.64
4230	749.40	753.26	757.15	761.07	765.02	768.21	769.01	773.02	774.64	777.07	781.15	785.26	789.40
4255	737.06	740.92	744.81	748.73	752.68	755.87	756.67	760.68	762.30	764.73	768.81	772.92	777.06
4259.52	735.77	739.63	743.52	747.44	751.39	754.58	755.38	759.39	761.01	763.44	767.52	771.63	775.77
4277.88	733.44	737.30	741.19	745.11	749.06	752.25	753.05	757.06	758.68	761.11	765.19	769.30	773.44
4280	733.47	737.33	741.22	745.14	749.09	752.28	753.08	757.09	758.71	761.14	765.22	769.33	773.47
4305	738.47	742.33	746.22	750.14	754.09	757.28	758.08	762.09	763.71	766.14	770.22	774.33	778.47
4330	751.91	755.77	759.66	763.59	767.54	770.72	771.52	775.54	777.15	779.59	783.66	787.77	791.91
4355	773.66	777.52	781.41	785.33	789.28	792.47	793.27	797.28	798.90	801.33	805.41	809.52	813.66
4380	803.56	807.42	811.31	815.23	819.19	822.37	823.17	827.19	828.80	831.23	835.31	839.42	843.56
4405	841.48	845.34	849.23	853.15	857.10	860.29	861.09	865.10	866.72	869.15	873.23	877.34	881.48
4430	887.28	891.13	895.03	898.95	902.90	906.09	906.88	910.90	912.52	914.95	919.03	923.13	927.28
4455	940.82	944.68	948.57	952.49	956.44	959.63	960.43	964.44	966.06	968.49	972.57	976.68	980.82
4480	1001.97	1005.83	1009.72	1013.65	1017.60	1020.78	1021.58	1025.60	1027.21	1029.65	1033.72	1037.83	1041.97

Source: Cboe

Cboe.com Online Calculator

- Cboe will create online trading support tools and data.
- The daily futures settlement price grids presented in this document will be available to traders on Cboe.com (see APPENDIX for examples). Trader enters the following:
 - Contract expiration selection
 - S&P 500 daily settlement price range
 - Implied variance (vol) range
 - Current intraday estimates for index and implied variance (vol)
- Grid generation uses Equation (4) inputs, prior day realized variance and inputs to generate the daily futures settlement price grid.
- Values associated with previous day index and vol, and instantaneous index and vol estimates are highlighted.
- Online tool provided for convenience. Traders may choose to implement customized tooling using Equation (4) and proprietary forecasts and tooling for intraday trading support.



APPENDIX

Example 20-day contract history

Example – 20-day listed contract

Date	n	N	Idx(n)	Idx(n-1)	DayVar	DayVarSum	EodVarSwap	EstDsv	EodContVega
2022-02-16	0	20	0	0	0.0000	0.0000	27.83	774.5089	55.66
2022-02-17	1	20	4380.26	4475.01	4.5798	4.5798	29.38	877.7309	55.82
2022-02-18	2	20	4348.87	4380.26	0.5173	5.0971	29.37	840.5603	52.87
2022-02-22	3	20	4304.76	4348.87	1.0393	6.1364	29.30	807.0349	49.81
2022-02-23	4	20	4225.50	4304.76	3.4536	9.5900	29.90	836.0414	47.84
2022-02-24	5	20	4288.70	4225.50	2.2041	11.7940	29.23	789.3992	43.85
2022-02-25	6	20	4384.65	4288.70	4.8957	16.6897	28.35	772.8956	39.69
2022-02-28	7	20	4373.94	4384.65	0.0598	16.7495	29.12	762.2268	37.86
2022-03-01	8	20	4306.26	4373.94	2.4319	19.1813	31.36	831.7547	37.63
2022-03-02	9	20	4386.54	4306.26	3.4118	22.5931	30.59	799.3347	33.65
2022-03-03	10	20	4363.49	4386.54	0.2776	22.8707	30.56	755.1275	30.56
2022-03-04	11	20	4328.87	4363.49	0.6345	23.5052	31.58	744.9490	28.42
2022-03-07	12	20	4201.09	4328.87	8.9775	32.4827	33.40	855.5065	26.72
2022-03-08	13	20	4170.70	4201.09	0.5271	33.0098	33.37	805.6688	23.36
2022-03-09	14	20	4277.88	4170.70	6.4382	39.4481	32.35	811.0024	19.41
2022-03-10	15	20	4259.52	4277.88	0.1850	39.6331	31.95	754.5771	15.98
2022-03-11	16	20	4204.31	4259.52	1.7021	41.3351	32.32	729.7389	12.93
2022-03-14	17	20	4173.11	4204.31	0.5548	41.8899	33.04	691.5594	9.91
2022-03-15	18	20	4262.45	4173.11	4.4870	46.3769	32.01	686.8134	6.40
2022-03-16	19	20	4357.86	4262.45	4.9005	51.2774	30.37	692.2122	3.04
2022-03-17	20	20	4345.11	4357.86	0.0859	51.3633	0.00	647.1770	0.00

Source: Cboe

Variance Price Grid (n=5)

Prior day realized daily variance = 9.5900

VOL	28.25	28.50	28.75	29.00	29.23	29.25	29.50	29.75	29.90	30.00	30.25	30.50	30.75
VEGA	42.38	42.75	43.13	43.50	43.85	43.88	44.25	44.63	44.85	45.00	45.38	45.75	46.13
4025	1017.14	1027.78	1038.52	1049.35	1059.39	1060.27	1071.28	1082.39	1089.10	1093.60	1104.89	1116.28	1127.77
4050	946.12	956.76	967.49	978.32	988.37	989.24	1000.26	1011.37	1018.08	1022.57	1033.87	1045.26	1056.74
4075	885.11	895.75	906.48	917.31	927.35	928.23	939.25	950.36	957.07	961.56	972.86	984.25	995.73
4100	833.92	844.56	855.30	866.12	876.17	877.05	888.06	899.17	905.88	910.37	921.67	933.06	944.55
4125	792.39	803.03	813.76	824.59	834.64	835.51	846.53	857.64	864.35	868.84	880.14	891.53	903.01
4150	760.34	770.98	781.71	792.54	802.58	803.46	814.48	825.59	832.30	836.79	848.09	859.48	870.96
4175	737.59	748.24	758.97	769.80	779.84	780.72	791.74	802.84	809.56	814.05	825.34	836.74	848.22
4200	724.00	734.64	745.37	756.20	766.24	767.12	778.14	789.25	795.96	800.45	811.75	823.14	834.62
4225	719.38	730.02	740.76	751.59	761.63	762.51	773.52	784.63	791.34	795.84	807.13	818.52	830.01
4225.50	719.38	730.02	740.76	751.58	761.63	762.51	773.52	784.63	791.34	795.83	807.13	818.52	830.01
4250	723.59	734.23	744.97	755.79	765.84	766.72	777.73	788.84	795.55	800.04	811.34	822.73	834.22
4275	736.47	747.11	757.85	768.67	778.72	779.60	790.61	801.72	808.43	812.92	824.22	835.61	847.10
4288.70	747.15	757.79	768.53	779.35	789.40	790.28	801.29	812.40	819.11	823.60	834.90	846.29	857.78
4300	757.87	768.51	779.24	790.07	800.12	800.99	812.01	823.12	829.83	834.32	845.62	857.01	868.49
4325	787.64	798.28	809.01	819.84	829.88	830.76	841.78	852.89	859.60	864.09	875.39	886.78	898.26
4350	825.63	836.27	847.00	857.83	867.87	868.75	879.77	890.88	897.59	902.08	913.38	924.77	936.25
4375	871.70	882.34	893.07	903.90	913.95	914.82	925.84	936.95	943.66	948.15	959.45	970.84	982.32
4400	925.71	936.36	947.09	957.92	967.96	968.84	979.86	990.96	997.68	1002.17	1013.46	1024.86	1036.34
4425	987.54	998.18	1008.91	1019.74	1029.78	1030.66	1041.68	1052.79	1059.50	1063.99	1075.29	1086.68	1098.16

Source: Cboe

Variance Price Grid (n=10)

Prior day realized daily variance = 22.5931

VOL	29.25	29.50	29.75	30.00	30.25	30.50	30.56	30.59	30.75	31.00	31.25	31.50	31.75
VEGA	29.25	29.50	29.75	30.00	30.25	30.50	30.56	30.59	30.75	31.00	31.25	31.50	31.75
4185	991.19	998.54	1005.94	1013.41	1020.94	1028.54	1030.37	1031.28	1036.19	1043.91	1051.69	1059.54	1067.44
4210	925.07	932.41	939.82	947.29	954.82	962.41	964.24	965.16	970.07	977.79	985.57	993.41	1001.32
4235	868.20	875.54	882.95	890.41	897.95	905.54	907.37	908.29	913.20	920.91	928.70	936.54	944.45
4260	820.41	827.76	835.16	842.63	850.16	857.76	859.59	860.51	865.41	873.13	880.91	888.76	896.66
4285	781.57	788.91	796.32	803.79	811.32	818.91	820.74	821.66	826.57	834.29	842.07	849.91	857.82
4310	751.50	758.84	766.25	773.72	781.25	788.84	790.67	791.59	796.50	804.22	812.00	819.84	827.75
4335	730.06	737.40	744.81	752.27	759.81	767.40	769.23	770.15	775.06	782.77	790.56	798.40	806.31
4360	717.09	724.44	731.84	739.31	746.84	754.44	756.27	757.19	762.09	769.81	777.59	785.44	793.34
4363.49	715.95	723.30	730.70	738.17	745.70	753.30	755.13	756.04	760.95	768.67	776.45	784.30	792.20
4385	712.47	719.81	727.22	734.69	742.22	749.81	751.65	752.56	757.47	765.19	772.97	780.81	788.72
4386.54	712.45	719.80	727.20	734.67	742.20	749.80	751.63	752.55	757.45	765.17	772.95	780.80	788.70
4410	716.04	723.38	730.79	738.26	745.79	753.38	755.21	756.13	761.04	768.76	776.54	784.38	792.29
4435	727.66	735.01	742.41	749.88	757.41	765.01	766.84	767.76	772.66	780.38	788.16	796.01	803.91
4460	747.21	754.55	761.96	769.43	776.96	784.55	786.38	787.30	792.21	799.93	807.71	815.55	823.46
4485	774.54	781.88	789.29	796.76	804.29	811.88	813.72	814.63	819.54	827.26	835.04	842.88	850.79
4510	809.53	816.87	824.28	831.75	839.28	846.87	848.70	849.62	854.53	862.25	870.03	877.87	885.78
4535	852.04	859.39	866.79	874.26	881.79	889.39	891.22	892.14	897.04	904.76	912.54	920.39	928.29
4560	901.96	909.31	916.71	924.18	931.71	939.31	941.14	942.06	946.96	954.68	962.46	970.31	978.21
4585	959.16	966.51	973.91	981.38	988.91	996.51	998.34	999.26	1004.16	1011.88	1019.66	1027.51	1035.41

Source: Cboe

Variance Price Grid (n=15)

Prior day realized daily variance = 39.4481

VOL	30.75	31.00	31.25	31.50	31.75	31.95	32.00	32.25	32.35	32.50	32.75	33.00	33.25
VEGA	15.38	15.50	15.63	15.75	15.88	15.98	16.00	16.13	16.18	16.25	16.38	16.50	16.63
4080	1016.06	1019.92	1023.81	1027.73	1031.68	1034.87	1035.67	1039.68	1041.30	1043.73	1047.81	1051.92	1056.06
4105	947.85	951.71	955.60	959.52	963.48	966.66	967.46	971.48	973.09	975.52	979.60	983.71	987.85
4130	889.38	893.24	897.13	901.05	905.00	908.19	908.99	913.00	914.62	917.05	921.13	925.24	929.38
4155	840.47	844.32	848.22	852.14	856.09	859.28	860.07	864.09	865.71	868.14	872.22	876.32	880.47
4180	800.94	804.80	808.69	812.61	816.57	819.75	820.55	824.57	826.18	828.61	832.69	836.80	840.94
4205	770.64	774.50	778.39	782.31	786.26	789.45	790.25	794.26	795.88	798.31	802.39	806.50	810.64
4230	749.40	753.26	757.15	761.07	765.02	768.21	769.01	773.02	774.64	777.07	781.15	785.26	789.40
4255	737.06	740.92	744.81	748.73	752.68	755.87	756.67	760.68	762.30	764.73	768.81	772.92	777.06
4259.52	735.77	739.63	743.52	747.44	751.39	754.58	755.38	759.39	761.01	763.44	767.52	771.63	775.77
4277.88	733.44	737.30	741.19	745.11	749.06	752.25	753.05	757.06	758.68	761.11	765.19	769.30	773.44
4280	733.47	737.33	741.22	745.14	749.09	752.28	753.08	757.09	758.71	761.14	765.22	769.33	773.47
4305	738.47	742.33	746.22	750.14	754.09	757.28	758.08	762.09	763.71	766.14	770.22	774.33	778.47
4330	751.91	755.77	759.66	763.59	767.54	770.72	771.52	775.54	777.15	779.59	783.66	787.77	791.91
4355	773.66	777.52	781.41	785.33	789.28	792.47	793.27	797.28	798.90	801.33	805.41	809.52	813.66
4380	803.56	807.42	811.31	815.23	819.19	822.37	823.17	827.19	828.80	831.23	835.31	839.42	843.56
4405	841.48	845.34	849.23	853.15	857.10	860.29	861.09	865.10	866.72	869.15	873.23	877.34	881.48
4430	887.28	891.13	895.03	898.95	902.90	906.09	906.88	910.90	912.52	914.95	919.03	923.13	927.28
4455	940.82	944.68	948.57	952.49	956.44	959.63	960.43	964.44	966.06	968.49	972.57	976.68	980.82
4480	1001.97	1005.83	1009.72	1013.65	1017.60	1020.78	1021.58	1025.60	1027.21	1029.65	1033.72	1037.83	1041.97

Source: Cboe

Variance Price Grid (n=19)

Prior day realized daily variance = 49.3769

VOL	30.00	30.25	30.37	30.50	30.75	31.00	31.25	31.50	31.75	32.00	32.01	32.25	32.50
VEGA	3.00	3.03	3.04	3.05	3.08	3.10	3.13	3.15	3.18	3.20	3.20	3.23	3.25
4060	927.71	928.46	928.82	929.22	929.98	930.76	931.53	932.32	933.11	933.91	933.94	934.71	935.52
4085	857.18	857.93	858.29	858.69	859.45	860.23	861.00	861.79	862.58	863.38	863.41	864.18	864.99
4110	796.49	797.24	797.60	798.00	798.77	799.54	800.32	801.10	801.89	802.69	802.72	803.49	804.30
4135	745.46	746.22	746.58	746.98	747.74	748.51	749.29	750.08	750.87	751.66	751.69	752.47	753.28
4160	703.93	704.68	705.05	705.44	706.21	706.98	707.76	708.54	709.33	710.13	710.16	710.93	711.74
4185	671.72	672.47	672.84	673.23	674.00	674.77	675.55	676.33	677.12	677.92	677.95	678.72	679.53
4210	648.67	649.42	649.78	650.18	650.94	651.72	652.49	653.28	654.07	654.87	654.90	655.67	656.48
4235	634.61	635.36	635.73	636.12	636.89	637.66	638.44	639.22	640.01	640.81	640.84	641.61	642.42
4260	629.39	630.14	630.51	630.90	631.67	632.44	633.22	634.00	634.79	635.59	635.62	636.39	637.20
4262.45	629.35	630.10	630.47	630.86	631.63	632.40	633.18	633.96	634.75	635.55	635.58	636.35	637.16
4285	632.86	633.61	633.97	634.37	635.14	635.91	636.69	637.47	638.26	639.06	639.09	639.86	640.67
4310	644.86	645.61	645.97	646.37	647.13	647.91	648.68	649.47	650.26	651.06	651.09	651.86	652.67
4335	665.24	665.99	666.36	666.75	667.52	668.29	669.07	669.85	670.64	671.44	671.47	672.24	673.05
4357.86	691.10	691.85	692.21	692.61	693.37	694.15	694.92	695.71	696.50	697.30	697.33	698.10	698.91
4360	693.86	694.62	694.98	695.38	696.14	696.91	697.69	698.48	699.27	700.06	700.10	700.87	701.68
4385	730.59	731.34	731.70	732.10	732.86	733.64	734.41	735.20	735.99	736.79	736.82	737.59	738.40
4410	775.27	776.02	776.38	776.78	777.55	778.32	779.10	779.88	780.67	781.47	781.50	782.27	783.08
4435	827.77	828.52	828.89	829.28	830.05	830.82	831.60	832.38	833.17	833.97	834.00	834.77	835.58
4460	887.97	888.72	889.08	889.48	890.24	891.02	891.79	892.58	893.37	894.17	894.20	894.97	895.78

Source: Cboe

APPENDIX

**Example 20-day contract final
settlement value in the presence of
a market disruption date**

Final Settlement Value With Disruption Date

Market disruption date on 2022-03-01 with zero variance accrual on that date.

Date	n	N	Idx(n)	Idx(n-1)	DayVar	DayVarSum
2022-02-16	0	20	0	0	0.0000	0.0000
2022-02-17	1	20	4380.26	4475.01	4.5798	4.5798
2022-02-18	2	20	4348.87	4380.26	0.5173	5.0971
2022-02-22	3	20	4304.76	4348.87	1.0393	6.1364
2022-02-23	4	20	4225.50	4304.76	3.4536	9.5900
2022-02-24	5	20	4288.70	4225.50	2.2041	11.7940
2022-02-25	6	20	4384.65	4288.70	4.8957	16.6897
2022-02-28	7	20	4373.94	4384.65	0.0598	16.7495
2022-03-01	8	20	4373.94	4373.94	0.0000	16.7495
2022-03-02	9	20	4386.54	4373.94	0.0827	16.8322
2022-03-03	10	20	4363.49	4386.54	0.2776	17.1098
2022-03-04	11	20	4328.87	4363.49	0.6345	17.7443
2022-03-07	12	20	4201.09	4328.87	8.9775	26.7218
2022-03-08	13	20	4170.70	4201.09	0.5271	27.2489
2022-03-09	14	20	4277.88	4170.70	6.4382	33.6872
2022-03-10	15	20	4259.52	4277.88	0.1850	33.8722
2022-03-11	16	20	4204.31	4259.52	1.7021	35.5742
2022-03-14	17	20	4173.11	4204.31	0.5548	36.1290
2022-03-15	18	20	4262.45	4173.11	4.4870	40.6161
2022-03-16	19	20	4357.86	4262.45	4.9005	45.5165
2022-03-17	20	20	4345.11	4357.86	0.0859	45.6024

Source: Cboe

Final settlement value = $252 / 20 * (45.6024) = 574.59$

Disclaimers:

- ▶ This document is a high-level overview of what is currently contemplated. The information included is subject to change and to more detailed provisions that would be put in place in connection with the planned relaunch of VA futures. Additionally, the planned relaunch of VA futures remains subject to regulatory review.
- ▶ There are important risks associated with transacting in any of the Cboe Company products or any digital assets discussed here. Before engaging in any transactions in those products or digital assets, it is important for market participants to carefully review the disclosures and disclaimers contained at: https://www.cboe.com/us_disclaimers.
- ▶ These products and digital assets are complex and are suitable only for sophisticated market participants. In certain jurisdictions, including the United Kingdom, Cboe Digital products are only permitted for investment professionals, certified sophisticated investors, or high net worth corporations and associations.
- ▶ These products involve the risk of loss, which can be substantial and, depending on the type of product, can exceed the amount of money deposited in establishing the position.
- ▶ Market participants should put at risk only funds that they can afford to lose without affecting their lifestyle.
- ▶ Hypothetical scenarios are provided for illustrative purposes only. The actual performance of financial products can differ significantly from the performance of a hypothetical scenario due to execution timing, market disruptions, lack of liquidity, brokerage expenses, transaction costs, tax consequences, and other considerations that may not be applicable to the hypothetical scenario.
- ▶ S&P, S&P 500, US500, 500, THE 500, SPDR, SPX, and DSPX are trade names or trademarks of S&P Dow Jones Indices, LLC, or its affiliates ("S&P"). Any products that have an S&P index as their underlying interest are not sponsored, endorsed, sold, or promoted by S&P and S&P makes no representation regarding the advisability of investing in any investment product that is based on any such indices.