SECURITIES AND EXCHANGE COMMISSION
(Release No. 34-86731; File No. SR-OCC-2019-005)

August 22, 2019

Self-Regulatory Organizations; The Options Clearing Corporation; Order Approving Proposed Rule Change Related to The Options Clearing Corporation's Vanilla Option Model and Smoothing Algorithm

I. INTRODUCTION

On June 28, 2019, the Options Clearing Corporation ("OCC") filed with the Securities and Exchange Commission ("Commission") the proposed rule change SR-OCC-2019-005 ("Proposed Rule Change") pursuant to Section 19(b) of the Securities Exchange Act of 1934 ("Exchange Act")[1] and Rule 19b-4[2] thereunder to propose changes to OCC's margin methodology regarding the estimation of prices for listed options contracts.[3] The Proposed Rule Change was published for public comment in the Federal Register on July 9, 2019,[4] and the Commission has received no comments regarding the Proposed Rule Change.[5] This order

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1 15 U.S.C. 78s(b)(1).

2 17 CFR 240.19b-4.

3 See Notice of Filing infra note 4, at 84 Fed.Reg. 32821.

4 Securities Exchange Act Release No. 886296 (July 3, 2019), 84 Fed.Reg. 32821 (July 9, 2019) (SR-OCC-2019-004) ("Notice of Filing"). OCC also filed a related advance notice (SR-OCC-2019-804) ("Advance Notice") with the Commission pursuant to Section 806(e)(1) of Title VIII of the Dodd-Frank Wall Street Reform and Consumer Protection Act, entitled the Payment, Clearing, and Settlement Supervision Act of 2010 and Rule 19b-4(n)(1)(i) under the Exchange Act. 12 U.S.C. 5465(e)(1). 15 U.S.C. 78s(b)(1) and 17 CFR 240.19b-4, respectively. The Advance Notice was published in the Federal Register on July 31, 2019. Securities Exchange Act Release No. 86488 (Jul. 26, 2019), 84 Fed.Reg. 37373 (Jul. 31, 2019) (SR-OCC-2019-804).

5 Since the proposal contained in the Proposed Rule Change was also filed as an advance notice, all public comments received on the proposal are considered regardless of whether the comments are submitted on the Proposed Rule Change or Advance Notice.

approves the Proposed Rule Change.

II. BACKGROUND

The System for Theoretical Analysis and Numerical Simulations ("STANS") is OCC's methodology for calculating margin requirements. STANS margin requirements are driven by several components, each reflecting a different aspect of risk. Two primary components of STANS are the models that OCC uses to (1) generate theoretical values, implied volatilities, and certain risk sensitivities for plain vanilla listed options (the "Vanilla Option Model");[6] and (2) estimate fair prices of listed option contracts based on their bid and ask price quotes (the "Smoothing Algorithm").[7] The changes proposed in the Proposed Rule Change are designed to address five limitations of the current Vanilla Option Model and five limitations of the current Smoothing Algorithm.

A. Vanilla Option Model

OCC relies on the Vanilla Option Model to generate theoretical values, implied volatilities, and risk sensitivities for plain vanilla listed options. The theoretical values that OCC generates with the Vanilla Option Model are the estimated values (as opposed to current market

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6 Plain vanilla listed options are commonly understood to encompass options with standardized terms (e.g., a predetermined strike price, classification as a call vs. put) and settlement structures (e.g., American-style, European-style). As described in the Notice of Filing, the Vanilla Option Model is designed to address such options, including (1) all listed vanilla European and American options on exchange traded funds and exchange traded notes (collectively, "ETPs"), equities, equity indices, futures on equity indices, currencies or commodities, and (2) vanilla flexible exchange options ("vanilla FLEX options"). See Notice of Filing, 84 Fed.Reg. at 32817, n. 7. As of the time of filing, plain vanilla options accounted for approximately 95 percent of the total contracts cleared by OCC. See id.

7 OCC uses the Smoothing Algorithm to estimate prices on all plain vanilla listed options included in the Vanilla Option Model, as well as options on non-equity securities (e.g., the Cboe Volatility Index). See Notice of Filing, 84 Fed.Reg. at 32817.

prices) derived from algorithms that use a series of predetermined inputs.[8] Given the current market price of a plain vanilla option, OCC uses such algorithms to estimate the implied volatility of the option.[9] OCC uses the risk sensitivities that it calculates to measure potential changes in an option's price in relation to the asset underlying the option.[10] As discussed below, OCC proposes five changes to the Vanilla Option Model.

(1) Interest rates

The Vanilla Option Model currently assumes that interest rates remain constant over time. OCC proposes to revise the Vanilla Option Model to account for changes in interest rates over the life of an option. To model such interest rate changes, OCC would rely on an interest rate curve based on LIBOR, Eurodollar futures, and swap-rates.

(2) Dividends

The Vanilla Option Model currently assumes constant dividends such that future dividends would be based on an issuer's last paid or announced dividend. OCC has acknowledged, however, that prior dividends are not always an accurate predictor of future dividends.[11] OCC proposes to use dividend forecasts obtained from a third-party service

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8 For example, OCC generates theoretical values for American style options using a modified Jarrow-Rudd ("JR") binomial tree.

9 The implied volatility of an option is a measure of the expected future volatility of the option's underlying security at expiration, which is reflected in the current option premium in the market.

10 OCC uses the Vanilla Option Model to calculate Delta, Gamma, and Vega. Delta measures the change in the price of an option with respect to a change in the price of an underlying asset. Gamma measures the change in Delta in response to a 1 percent change in the price of the underlying asset. Vega measures the change in the price of an option corresponding to a 1 percent change in the underlying asset's volatility.

11 See Notice of Filing, 84 Fed.Reg. at 32818.

provider as an input to the Vanilla Option Model instead of relying on the issuer's last paid or announced dividend.

(3) Borrowing Costs

The Vanilla Option Model does not currently account for the costs that may be incurred by an option buyer or seller who must borrow the security underlying an option (i.e., "Borrowing Costs"). OCC has acknowledged that the failure to incorporate Borrowing Costs could cause OCC to model implied volatilities inconsistently across puts and calls with the same strike and tenor.[12] OCC proposes to calculate Borrowing Costs based on the market prices of options and futures, and to use such Borrowing Costs as an input of the Vanilla Option Model.

(4) Binomial Tree

As noted above, the Vanilla Option Model uses the JR binomial tree to generate theoretical values for American-style options. OCC has acknowledged, however, that the Leisen Reimer ("LR") binomial tree has a higher rate of convergence than the JR tree.[13] OCC proposes to replace the JR binomial tree with the LR binomial tree in the Vanilla Option Model.

Further, the Vanilla Option Model employs a fixed number of steps in the JR binomial tree. OCC has acknowledged that the current number of steps is insufficient for accurately evaluating long-dated options.[14] OCC proposes to introduce a variable number of steps in the LR binomial tree. As proposed, the minimum number of steps in the LR binomial tree would be greater than the current fixed number of steps in the JR binomial tree that is currently used by the Vanilla Option Model.

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12 See id.

13 See id.

14 See id.

(5) Risk sensitivities.

OCC currently uses the Vanilla Option Model to calculate three risk sensitivities: Delta, Gamma, and Vega. OCC stated that the Vanilla Option Model does not currently calculate Theta or Rho.[15] OCC proposes to use the Vanilla Option Model to calculate Theta and Rho while continuing to calculate Delta, Gamma, and Vega.

B. Smoothing Algorithm

The Smoothing Algorithm is a four-step process that OCC uses to estimate fair values for plain vanilla listed options based on closing bid and ask price quotes. First, OCC filters out certain poor-quality price quotes.[16] Second, OCC estimates the forward prices of the securities underlying the options. Third, OCC generates theoretical option prices based on bid and ask quotes and the forward prices estimated in the previous step.[17] Finally, as described in the Notice of Filing, OCC constructs a volatility surface based on the smoothed prices from the prior steps, and uses that surface to approximate prices for contracts that were filtered out in the Smoothing Algorithm's first step.[18] As discussed below, OCC proposes to make five changes to

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15 See id. Theta is a measurement of the relationship between an option's price and remaining time to expiration. Rho is a measurement of the relationship between an option's price and changes in the risk-free rate.

16 As described in the Notice of Filing, price quotes are excluded from the algorithm if they meet one or more of the following conditions: (i) prices for options that expired or have a remaining maturity of less than a certain number of days, where that number is specified by a control parameter; (ii) prices for options that have only "one-sided contracts" (i.e., contracts for which prices exist only for either the call or the put, but not for both); (iii) prices for options whose ask prices are zero; (iv) prices for options with negative bid and ask spreads; or (v) prices for any American options if the ask price is less than the intrinsic value of the option. See Notice of Filing, 84 Fed.Reg. at 32817, n. 11.

17 OCC applies a series of constraints when generating such theoretical option prices based on the implied forward prices calculated in the Smooth Algorithm's second step.

18 See Notice of Filing, 84 Fed.Reg. at 32818, n. 17.

the Smoothing Algorithm.

(1) Model Inconsistencies

Currently, the Smoothing Algorithm uses the LR binomial tree as part of the price smoothing process. As discussed above, the Vanilla Option Model currently uses the JR binomial tree. OCC has acknowledged that the inconsistency between the Vanilla Option Model and the Smoothing Algorithm could result in violations of put and call parity in OCC's margin calculations.[19] The proposal to replace the JR binomial tree with the LR binomial tree in the Vanilla Option Model would resolve the inconsistency between the Vanilla Option Model and the Smoothing Algorithm.

(2) Theoretical Spot Prices

As noted above, the Smoothing Algorithm estimates the forward prices of securities underlying options, and uses the estimated forward prices to generate theoretical option prices. The estimation of forward prices relies, in part, on spot prices. Currently, the Smoothing Algorithm approximates spot prices for indices underlying options (i.e., theoretical spot prices) based on the prices of related index futures observed prior to the close of the futures markets. The relevant futures markets close at 3:15 p.m. Central Time; however, the markets for the underlying indices close at 3 p.m. Central Time. OCC has acknowledged that this difference in closing times could result in poorly smoothed prices whenever options trading between 3:00 p.m. and 3:15 p.m. is volatile, which could result in problems in OCC's margin calculations.[20] OCC

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[19] See Notice of Filing, 84 Fed.Reg. at 32818.

[20] See Notice of Filing, 84 Fed.Reg. at 32818-19.

proposes, for the purpose of calculating theoretical spot prices, to rely on basis futures[21] rather than index futures. The relevant markets for basis futures close at 3 p.m. Central Time, which aligns with the 3 p.m. close of the market for the underlying indices.

(3) Volatility Cap

As noted above, OCC uses the Smoothing Algorithm to construct a volatility surface based on theoretical option prices. The process for constructing such a volatility surface includes the application of certain restrictions to ensure that prices satisfy arbitrage-free conditions and bid and ask spread constraints. One such restriction involves capping unacceptably high volatilities. Currently, the Smoothing Algorithm imposes an abrupt cap on volatilities that causes the rate of change of volatility to change sharply at the point of the cap (i.e., the current cap causes a sudden change in an otherwise gradual process). OCC has acknowledged that such a jump may create negative convexity of the option prices versus strike prices (i.e., butterfly arbitrage opportunities).[22] OCC proposes to impose a more gradual process for constraining unacceptably high volatilities with the intention of eliminating opportunities for butterfly arbitrage.

(4) Short-dated FLEX options

Currently, the Smoothing Algorithm generates prices for short-dated FLEX options by combining current market prices with implied volatilities from the prior day. OCC has acknowledged that combining prices and implied volatilities from different days in this way may

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[21] Basis futures prices represent the spreads between the prices of futures and the assets underlying those futures. OCC states that these spreads are relatively stable throughout the day, including between their closing at 3:00 p.m. and the closing of the related index options market at 3:15 p.m. See Notice of Filing, 84 Fed.Reg. at 32819.

[22] See id.

cause the Smoothing Algorithm to generate option prices that are inconsistent with current market prices.[23] OCC proposes to generate prices for short-dated FLEX options based on current market prices and the volatilities implied by such prices.[24]

(5) Borrowing Costs

Currently, the Smoothing Algorithm does not directly consider Borrowing Costs when estimating fair prices for listed options. OCC has acknowledged that the Smoothing Algorithm instead relies on implied dividends,[25] which can result in mispricing.[26] OCC proposes to use Borrowing Costs, implied from listed option prices, as an independent input into the Smoothing Algorithm.

III. DISCUSSION AND COMMISSION FINDINGS

Section 19(b)(2)(C) of the Exchange Act directs the Commission to approve a proposed rule change of a self-regulatory organization if it finds that such proposed rule change is consistent with the requirements of the Exchange Act and the rules and regulations thereunder applicable to such organization.[27] After carefully considering the Proposed Rule Change, the Commission finds the proposal is consistent with the requirements of the Exchange Act and the rules and regulations thereunder applicable to OCC. More specifically, the Commission finds

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23 See id.

24 OCC is not proposing to change the Smoothing Algorithm's process regarding the generation of prices for long-dated FLEX options. See Notice of Filing, 84 Fed.Reg. at 32819, n. 28.

25 Implied dividends are a combination of Borrowing Costs and dividends. See Notice of Filing, 84 Fed.Reg. at 32819, n. 29.

26 See id.

27 15 U.S.C. 78s(b)(2)(C).

that the proposal is consistent with Section 17A(b)(3)(F) of the Exchange Act[28] and Rules 17Ad-22(e)(6)(i) and (iii).[29]

A. Consistency with Section 17A(b)(3)(F) of the Exchange Act

Section 17A(b)(3)(F) of the Exchange Act requires that the rules of a clearing agency be designed to, among other things, assure the safeguarding of securities and funds which are in the custody or control of the clearing agency or for which it is responsible.[30] Based on its review of the record, the Commission believes that the proposed changes are designed to assure the safeguarding of securities and funds which are in OCC's custody or control for the reasons set forth below.

OCC manages its credit exposure to Clearing Members, in part, through the collection of collateral based on OCC's margin methodology. As noted above, two primary components of OCC's margin methodology are the Vanilla Option Model and the Smoothing Algorithm. Several of the proposed changes would address shortcomings in the assumptions underlying the Vanilla Option Model and the Smoothing Algorithm. The introduction of dynamic, rather than constant, interest rate and dividend data as inputs to the Vanilla Option Model would provide a more accurate representation of option market dynamics. Additionally, the use of basis futures, as opposed to index futures, to generate theoretical spot prices for indices underlying options could avoid problems in OCC's margin calculations arising from differences in market closing times. Similarly, the estimating prices for short-dated FLEX options based on price and implied volatility data from the same day (as opposed to different days) would better align with prices

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28 15 U.S.C. 78q-1(b)(3)(F).

29 17 CFR 240.17Ad-22(e)(6)(i) and (iii).

30 15 U.S.C. 78q-1(b)(3)(F).

observed in the market. Further, the introduction of Borrowing Costs would allow OCC to account for a known cost not currently addressed in OCC's models. The Commission believes that the proposed changes described above would better align the Vanilla Option Model and the Smoothing Algorithm with the subject matter that they are designed to model.

Other of the proposed changes would address model design issues identified in the Vanilla Option Model and the Smoothing Algorithm. As noted above, OCC proposes to change the way the Smoothing Algorithm addresses unacceptably high volatilities to ensure that theoretical option prices satisfy certain arbitrage-free conditions (i.e., eliminating butterfly arbitrage opportunities). OCC also proposes to use the same binomial tree in both the Vanilla Option Model and the Smoothing Algorithm to enhance model consistency. The proposal to use a LR binomial tree with a variable number of steps, as opposed to the current fixed number of steps in a JR binomial tree, would allow the Vanilla Option Model to more accurately price long-dated options. Additionally, the move to the LR binomial tree would allow OCC to generate additional risk sensitivity data. Such data could allow OCC to better understand the risks present in Clearing Members' portfolios.

The Vanilla Option Model and the Smoothing Algorithm are two of the fundamental components of OCC's margin methodology. Improving the accuracy and precision of these models would improve the accuracy and precision of OCC's margin calculations, and could give OCC a better understanding of the risks posed by its Clearing Members. Improving OCC's margin calculations and understanding of its exposures would facilitate OCC's ability to manage potential Clearing Member defaults. The Commission believes that the proposed changes would improve OCC's margin methodology as described above. Improving OCC's margin methodology could reduce the potentiality that OCC would mutualize a loss arising out of the process of closing out a defaulted Clearing Member's portfolio. While unavoidable under certain circumstances, reducing the potentiality of loss mutualization during periods of market stress could reduce the potential knock-on effects to non-defaulting Clearing Members, their customers and the broader options market arising out of a Clearing Member default. The Commission believes, therefore, that the proposed improvements to OCC's margin methodology are consistent with assuring the safeguarding of securities and funds which are in OCC's custody or control or for which it is responsible consistent with the requirements of Section 17A(b)(3)(F) of the Exchange Act.[31]

B. Consistency with Rule 17Ad-22(e)(6)(i) under the Exchange Act

Rule 17Ad-22(e)(6)(i) under the Exchange Act requires that a covered clearing agency establish, implement, maintain, and enforce written policies and procedures reasonably designed to cover, if the covered clearing agency provides central counterparty services, its credit exposures to its participants by establishing a risk-based margin system that, at a minimum, considers, and produces margin levels commensurate with, the risks and particular attributes of each relevant product, portfolio, and market.[32]

As discussed above, certain changes that OCC proposes would be designed to better align the assumptions underlying the Vanilla Option Model and the Smoothing Algorithm with the products to which they are applied as well as the related markets. The introduction of dynamic, rather than constant, interest rate and dividend data as inputs to the Vanilla Option Model would provide a more accurate representation of the particular attributes of options markets. The estimation of prices for short-dated FLEX options based on prices and implied volatilities from

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[31] 15 U.S.C. 78q-1(b)(3)(F).

[32] 17 CFR 240.17Ad-22(e)(6)(i).

the same day (as opposed to different days) would better align with prices observed in the market. Additionally, accounting for Borrowing Costs would better align OCC's margin requirements with particular attributes of plain vanilla options by accounting for the costs facing options market participants. Further, the move to a LR binomial tree in the Vanilla Option Model would allow OCC to generate additional risk data relevant to the products that OCC clears. The Commission believes, therefore, that adoption of the proposed changes designed to align OCC's models assumptions with market dynamics are consistent with Exchange Act Rule 17Ad-22(e)(6)(i).[33]

C. Consistency with Rule 17Ad-22(e)(6)(i) under the Exchange Act

Rule 17Ad-22(e)(6)(iii) under the Exchange Act requires that a covered clearing agency establish, implement, maintain, and enforce written policies and procedures reasonably designed to cover, if the covered clearing agency provides central counterparty services, its credit exposures to its participants by establishing a risk-based margin system that, at a minimum, calculates margin sufficient to cover its potential future exposure to participants in the interval between the last margin collection and the close out of positions following a participant default.[34]

As discussed above, certain changes that OCC proposes to make to the Vanilla Option Model and the Smoothing Algorithm would address model design issues. OCC proposes to change the way the Smoothing Algorithm addresses unacceptably high volatilities to ensure that theoretical option prices satisfy certain arbitrage-free conditions (i.e., eliminating butterfly arbitrage opportunities). OCC also proposes to enhance model consistency by using the same binomial tree in both the Vanilla Option Model and the Smoothing Algorithm. Further, the

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[33] Id.

[34] 17 CFR 240.17Ad-22(e)(6)(iii).

proposal to replace the binomial tree's fixed number of steps with a variable number of steps would allow the Vanilla Option Model to more accurately price long-dated options. Finally, the use of basis futures, as opposed to index futures, to generate theoretical spot prices for indices underlying options could avoid problems in OCC's margin calculations arising from market volatility between 3:00 p.m. and 3:15 p.m.

The Commission believes that changes proposed to reduce model risk generally facilitate the effective functioning of the relevant models. The Vanilla Option Model and the Smoothing Algorithm estimate prices that OCC uses to set margin requirements. Better price estimates would allow OCC to better calculate margin sufficient to cover its potential future exposure to Clearing Members. The Commission believes, therefore, that adoption of the changes proposed to address design issues in OCC's margin methodology are consistent with Exchange Act Rule 17Ad-22(e)(6)(iii).[35]

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[35] Id.

IV. CONCLUSION

On the basis of the foregoing, the Commission finds that the Proposed Rule Change is consistent with the requirements of the Exchange Act, and in particular, the requirements of Section 17A of the Exchange Act[36] and the rules and regulations thereunder.

IT IS THEREFORE ORDERED, pursuant to Section 19(b)(2) of the Exchange Act,[37] that the Proposed Rule Change (SR-OCC-2019-005) be, and hereby is, approved.

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.[38]

Jill M. Peterson
Assistant Secretary

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36 In approving this Proposed Rule Change, the Commission has considered the proposed rules' impact on efficiency, competition, and capital formation. See 15 U.S.C. 78c(f).

37 15 U.S.C. 78s(b)(2).

38 17 CFR 200.30-3(a)(12).