Submission No. 24-29
March 28, 2024

Mr. Christopher J. Kirkpatrick
Office of the Secretariat
Commodity Futures Trading Commission
Three Lafayette Centre
1155 21st Street, NW
Washington, DC 20581

**Re: Amendments to the Options Valuation Model used to Determine Settlement Prices for Certain Contracts - Submission Pursuant to Section 5c(c)(1) of the Act and Regulation 40.6**

Dear Mr. Kirkpatrick:

Pursuant to Section 5c(c)(1) of the Commodity Exchange Act, as amended, and Commodity Futures Trading Commission ("Commission") Regulation 40.6(a), ICE Futures U.S., Inc. ("Exchange") hereby notifies the Commission that it will switch the options valuation model used to calculate settlement premium to the Finite Difference Method for American Options ("Model") for the following contracts ("Contracts") on the listed dates:

| **Product:** | **Methodology Change date:** |
|---|---|
| Cotton No. 2® Options & Weekly Options | 4/12/2024 |
| U.S. Dollar Index® Options | 4/15/2024 |
| FCOJ Options | 4/16/2024 |
| Canola Options | 4/17/2024 |
| Coffee "C"® Options & Weekly Options | 4/18/2024 |
| Sugar No. 11® Options & Weekly Options | 4/19/2024 |
| Cocoa Options | 4/22/2024 |

In accordance with Exchange Rule 4.35, the Exchange will use available market information to determine the settlement premium for options for strikes and combination structures with trading activity. The Exchange will generally use a valuation model to assist in the determination of settlement premium for options without trading activity based on a combination of activity in nearby strike prices, pricing of the underlying futures contract and the option valuation model. The Exchange currently uses a non-discounted version of the Black76 formula to determine the settlement premium in such circumstances. The new Model will better reflect the value of American style options where premium is paid at the time of purchase since the current method ignores early exercise and discounting. A description of the valuation calculation performed using the model is attached hereto as Exhibit A.

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The Exchange is not aware of any opposing views with respect to the changes. The Exchange certifies that the rule amendments comply with the requirements of the Commodity Exchange Act and the rules and regulations promulgated thereunder. Specifically, the amendments are consistent with Core Principles 3 and 10 as the Model will better reflect the value of the options for the Contracts. The Exchange further certifies that, concurrent with this filing, a copy of this submission was posted on the Exchange's website, which may be accessed at (https://www.theice.com/futures-us/regulation#rule-filings).

If you have any questions or need further information, please contact me at 212-748-4021 or at jason.fusco@theice.com.

Sincerely,

Jason V. Fusco
General Counsel
ICE Futures U.S.

Enc.

## EXHIBIT A

## American Options

This section provides a description of Finite Difference Method for American Options under a lognormal diffusion assumption, which is based on solving the Black-Scholes Partial Differential Equation (PDE):

$$\frac{\partial U(x,t)}{\partial t} = \frac{\sigma^2}{2}\frac{\partial^2 U(x,t)}{\partial x^2} - \frac{\sigma^2}{2}\frac{\partial U(x,t)}{\partial x} - r(t)U(x,t) \tag{1}$$

which is expressed in terms of the two variables $x$ and $t$, with $U(x,t)$ the price of the option, σ a volatility, and $r(t)$ a continuously compounded rate derived from the discount curve. The spatial variable is defined as $x = \ln(F/F_0)$, where $F$ is the futures price and $F_0$ is the initial futures price at the evaluation date. The time variable $t$ denotes the time to expiry, which decreases as time progresses forward towards the option expiry. By definition, $t = 0$ corresponds to option expiry and $t = T$ corresponds to the valuation date.

We discretize this PDE using a finite grid which is regular in the space ($x$) direction and irregular in the time ($t$) direction; the time spacing $\tau$ grows as time to expiry $t$ increases. We represent the function $U(x,t)$ at time $t$ as a vector $U^{(t)} = \left\{u_0^{(t)}, \dots, u_{N-1}^{(t)}\right\}$.

We impose an initial condition at option expiry: the holding value at expiry is given by the immediate exercise function $u_j = E_j$, where $E_j = \left(K - F_j\right)^+$ for a put option, $E_j = \left(F_j - K\right)^+$ for a call option, and $F_j = F_0 + x_j$.

We then find a numerical solution using a Crank-Nicolson scheme

$$\frac{U^{(t+1)} - U^{(t)}}{\tau} = \tfrac{1}{2}\left(\hat{L}U^{(t+1)} + \hat{L}U^{(t)}\right), \tag{2}$$

where $\hat{L}$ is the tridiagonal linear operator that results from expressing the PDE in terms of finite differences. With this scheme we mix adjacent timesteps in the spatial derivatives to obtain the intermediate timesteps as $\widetilde{U}^{(t)} = \frac{1}{2}\left(U^{(t+1)} + U^{(t)}\right)$. Using this definition, we then solve the equation $\left(1 - \frac{\tau}{2}\hat{L}\right)\widetilde{U} = U^{(t)}$ and use the solution to find the next time step according to $U^{(t+1)} = 2\widetilde{U} - U^{(t)}$.

Given this scheme, the intermediate timesteps $\widetilde{U}$ are most easily solved as a *free boundary problem*, where the free boundary is given by the optimal exercise boundary; below this boundary it is optimal to hold the option, while above it one should exercise immediately.

For put options, we start at $j = N - 2$ and recurse backward down towards $j = 1$ to find the optimal exercise boundary $j = j_b$; if it is not found, we set $j_b = 0$. We then set $\tilde{u}_j = E_j$ for all $j \leq j_b$ and determine the remaining values of $\tilde{u}_j$ ($j > j_b$) using forward recursion from the boundary.

To the contrary, for call options we start at $j = 1$ and recurse forward up towards $j = N - 2$ to find the optimal exercise boundary $j = j_b$; if it is not found, we set $j_b = N - 1$. We then set $\tilde{u}_j = E_j$ for all $j \geq j_b$ and determine the remaining values of $\tilde{u}_j$ ($j < j_b$) using backward recursion from the boundary.

Finally, when we reach the valuation date we represent the function $U_T(x) = U(x, t = T)$ using an Akima spline (Akima, 1970) on the 10 nodes surrounding the spot ($F = F_0$) node. The price of the option is given by $P = U_T(x = 0)$.

When computing the actual price of the option, we use both the immediate exercise function $E$ and the price of the equivalent European option $P_{Eur}$ as lower bounds:

$$P_{final} = max\left(P, P_{Eur}\left(F, K, \sigma, T_E, DF(T_E)\right), E\right). \tag{3}$$