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Estimating implied volatility for FLEX options

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Abstract: We summarize how the OCC estimates implied volatilities for FLEX.

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Short running title: Implied volatility for FLEX options

1. Introduction

This document describes OCC's current methodology for estimating implied volatilities as it relates to the valuation of FLEX (CBOE FLEXible EXchange[®]) options. OCC methodologies are regularly reviewed by the Quantitative Risk Management group, and change from time to time. While the methodology that is described here has been determined to be adequate, renewed attention on long-tenor FLEX contracts may well lead to revisions.

The remainder of this paper is organized as follows. Section 2 describes the market data that is used. Section 3 describes the interpolation and extrapolation methodologies.

2. Market data

2.1. Closing prices

To build the volatility surface used for both FLEX options and regular exchange-defined options, we start with closing prices for the regular options series. We define these as the midpoint between the closing highest bid and lowest ask quotations on Thomson-Reuters and/or Bloomberg. The prices are edited, if needed, to eliminate obvious arbitrage anomalies.

3. Extrapolation and interpolation

3.1. Interpolation & extrapolation in strike

For a given underlying, expiration, expiration type (European-style or American-style), and option type (put or call), a polynomial curve in moneyness (defined as strike price minus spot price) is fit to edited implied volatilities.

For options with moneyness within the range used for the fit, the polynomial is evaluated to determine the implied volatility.

For options with moneyness outside of the range used for the fit, the polynomial is evaluated at either the minimum or the maximum moneyness used for the fit.

For European-style FLEX options, the average of the interpolated/extrapolated put and call result is used.

3.2. Interpolation in tenor

For options whose tenors are non-standard (i.e. for which there is no polynomial fit as per above), the volatility is evaluated at the two closest tenors, and the results are interpolated linearly based on calendar days.

3.3. Extrapolation in tenor

For options whose tenor is longer than the longest tenor for which a curve is available, the longest two available tenors are used to determine if the at-the-money (spot) volatility term structure is positively or negatively sloped. In either case, an extrapolating curve in tenor is drawn based on the at-the-money (spot) volatilities for the longest two available tenors and the skew (based on the polynomial fit) for the given strike at the longest available tenor.

For a positively-sloped term structure, the extrapolating curve is limited above by the skew plus 1.05 times the at-the-money (spot) volatility for the longest available tenor. For a negatively-

sloped term structure, the extrapolating curve is limited below by 0.95 times the at-the-money (spot) volatility for the longest available tenor.