MARKET NOTICE

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**SUBJECT:** **UPDATED EDM ATM IMPLIED VOLATILITY MARK-TO-MARKET PROCESS**

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## 1. Introduction

The JSE Valuations team conducted a market consultation in May 2020 on the mark-to-market (MTM) methodology for at-the-money (ATM) implied volatility in the equity derivatives market (EDM). The scope of the proposed changes mainly covered adjustments to the qualifying criteria set for index option trades and introduction of a new methodology for incorporating bids and offers from the JSE order book in a flexible way. This initially covers expiries for the ALSI contract, the DTOP contract and the DCAP contract although other index options would also be considered for the same methodology. A summary of the topics covered includes:

- The introduction of the dynamic use of the JSE "Delta Options" functionality to allow members to put up volatility bids and offers on screen to facilitate the MTM process
- The ability to use a larger proportion of the existing trade data
- Combining the trade data and market quotes in a cascading process to better capture the market activity

This notice serves to inform all EDM market participants of the outcome of the consultation given the various sets of feedback received, and to define the update MTM methodology for ATM volatility in the EDM.

## 2. Description of the Mark-to-Market Methodology:

The proposed changes to the MTM methodology include the explicit reference to the JSE order book via a snapshot of prevailing bids and offers, as well as an expansion of the trade data that is considered in the process. The order

book snapshot ensures that additional relevant information that emerges at the end of the trading day plays a pivotal role in the process.

From the trade data, a **"Trade Weighted ATM Implied Volatility"** is determined. The order book snapshot allows for the determination of **"Quote Determined ATM Implied Volatility"** bids and offers.

### 2.1 Calculation of the closing ATM Implied Volatility

The trade weighted ATM implied volatility is the starting basis in the following cascading process:

- If the trade weighted ATM implied volatility is within the bid and offer spread determined from the quotes in the order book, then this is adopted as the MTM ATM implied volatility
- If the quote determined ATM implied volatility **bid** is better (higher) than the trade weighted ATM implied volatility, this is adopted as the MTM ATM implied volatility
- If the quote determined ATM implied volatility **offer** is better (lower) than the trade weighted ATM implied volatility, this is adopted as the MTM ATM implied volatility
- In the absence of trades against a particular expiry the preceding trading day's closing ATM implied volatility is used as the starting basis in the cascading process
- In the absence of both trades, and of eligible bids and offers in the order book against a particular expiry, a sticky-strike adjustment will be made to the previous day's closing ATM implied volatility to achieve the MTM ATM implied volatility for that particular trading day. Ideally the JSE would like to use this adjustment on as few occasions as possible in order to adopt the correct information in the MTM process.
- The process thus doesn't required for there to be both bids and offers as either may lead to the adjustment of the ATM implied volatility

Below is a detailed explanation of the calculation of the two key elements of the cascading process.

### 2.2 Calculation of the "Trade Weighted ATM Implied Volatility"

Trade data is included in the MTM process with the following criteria for qualifying trades:

- Inclusion of all trades booked during the trading day
- All trades of **100 contracts** or more (reduced from 500 contracts)
- All trades for strikes of moneyness **90% to 110%** (expanded from 95% to 105%)

The traded implied volatility per trade is transformed into an ATM implied volatility by applying a skew adjustment factor. The inputs required for this calculation are the prevailing skew for that expiry, traded implied volatility and moneyness of the trade. The moneyness of a strike is considered relative to the level at which the delta in the underlying index future for that expiry is executed, or agreed in the case where delta is crossed between the two parties to a trade.

$$\boldsymbol{Moneyness} = \frac{\boldsymbol{Strike}}{\boldsymbol{Underlying\ Future\ Reference}}$$

The moneyness is used to interpolate linearly for a skew adjustment factor from the prevailing skew. The skew adjustment factor is then subtracted from the traded implied volatility to obtain the trade implied ATM volatility.

$$\boldsymbol{Trade\ Implied\ ATM\ Volatility = Traded\ Implied\ Volatility - Skew\ Adjustment\ Factor}$$

For a particular expiry, the weighted ATM volatility is calculated as the weighted average Trade Implied ATM Volatility of all eligible trades, weighted by the number of contracts traded, using the formula**:**

$$\boldsymbol{Trade\ Weighted\ ATM\ Implied\ Volatility} = \frac{\sum_j \boldsymbol{i_j} \times \boldsymbol{Conts_j}}{\sum_j \boldsymbol{Conts_j}}$$

Where:

- $\boldsymbol{i_j}$ is the trade implied ATM volatility for the$\boldsymbol{j^{th}}$ eligible trade for a particular expiry
- $\boldsymbol{Conts_j}$ is the number of contracts traded for the $\boldsymbol{j^{th}}$ eligible trade for a particular expiry where $\boldsymbol{Conts_j \geq 100}$

**2.3 Calculation of "Quote Implied ATM Bids and Offers"**

The JSE's Delta Options allow for the on screen quoting of tradeable implied volatility bids and/or offers against particular strikes against particular contract expiries. This part of the methodology requires for trading members to put up bids and offers with the following conditions:

- Minimum quote size of **100 contracts**
    - This also ensures that should this be traded, it is automatically adopted in the calculation of the trade weighted ATM implied volatility as in 2.1 above.
- Strikes to be quoted within a 90% to 110% moneyness range of the prevailing level of the underlying future
- Quotes to be up on screen and thus **executable** for a **60 minute** period between **16h00 and 17h00**.
- A random snapshot of the order book will be taken in the **10 minute** period between **16h50 and 17h00**.

For every strike against which bids and/or offers are quoted (which is within the 90% to 110% moneyness range of the closing level of the JSE future) a skew adjustment will be applied to obtain quote determined ATM implied volatility bid-offer spread. The best bid and offer spread will be determined from all existing quotes in the order book.

$$\boldsymbol{Quote\ Determined\ ATM\ Implied\ Volatility\ Bid} = \boldsymbol{Quoted\ Implied\ Volatility\ Bid - Skew\ Adjustment\ Factor}$$

$$\boldsymbol{Quote\ Determined\ ATM\ Implied\ Volatility\ Offer} = \boldsymbol{Quoted\ Implied\ Volatility\ Offer - Skew\ Adjustment\ Facto}$$

## 3. Implementation

The JSE will implement this methodology amendment with immediate effect. The efficacy of the automated solution will be monitored by the team and formally reviewed after three months. Where necessary robust automated solutions are still being finalised, manual interventions will be made to ensure that the methodology works as designed. The valuations team is at hand to take any views regarding this implementation and to conduct any calls with members should any clarification be sought regarding the contents of this document. Please direct any written requests to valuations@jse.co.za

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