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MARKET NOTICE

Number:	**557/2020**
Relates to:	☐ Equity Market ☐ Equity Derivatives ☐ Commodity Derivatives ☐ Currency Derivatives ☒ Interest Rate Derivatives
Date:	15 October 2020
SUBJECT:	**BOND OPTION IMPLIED VOLATILITY SURFACE**
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1. EXECUTIVE SUMMARY

The growth in the Interest Rate Derivatives market has brought into the spotlight the mark-to-market (MTM) methodology employed for bond options. In particular, the MTM of the bond option implied volatility surface has been subject to a few enquiries. It was the intention of the workshop hosted by the JSE on the 18 September 2020 to bring together different market participants in order to get a broader set of views regarding the methodology. The proposals presented by the JSE at the workshop considered the various inputs received from different market players.

The outcome of the workshop was positive. A consensus was established as to the changes that will be made to the current methodology and process. The changes can be summarized as follows:

- Changing the mapping process (mapping from bonds to swaps) from using **"forward PV01"** to using a **"forward starting term to maturity"** (forward starting date being the expiry date of the underlying option). This date can be assumed to be the settlement date of the bond.
- Update the implied volatility surface in its entirety on a daily basis based on data received from the existing vendor provider of implied volatility surfaces to the JSE. This will also incorporate the ATM volatilities as observed on the broker screens.
    - A snapshot of the ATM bids and offers will be taken at any time between **15h45** and **16h00**

The Valuations team intends to go live with this process from **2 November 2020**.

2. EXISTING METHODOLOGY

The existing methodology uses, as the primary input, swaption implied volatility surfaces from a third party vendor provider. The methodology converts the yield implied volatilities from the swaptions to yield implied volatilities for bond options. The existing process is as described below:

1. Calculate the forward PV01 for each bond underlying the bond options assuming each listed expiry as the settlement date (forward starting date) for the bonds.
2. Calculate the forward PV01 for standard swap tenors from the bond option expiry dates using the JSE Zero Swap Curve (and the inputs used to bootstrap the curve).
3. Regardless of the underlying bond, the PV01, as a measure of interest rate risk, is then used to map the swaption implied volatility surface to the bond options.
4. A linear interpolation is used to map the bond option expiries to the standard tenors provided on the swaption implied volatility surface.
5. The ATM implied volatility bids and offers on interbank broker screens are then used to recalculate the mid volatility for each given swaption.
    a. This step ensures that the ATM implied volatility accounts for any significant moves that may have occurred on the trading day
    b. The files received from the vendor provider refer to data from the previous close. This data is as acquired from various inter-dealer brokers in the swaption market
6. The process is currently conducted once a week on a Wednesday. The volatilities per yield strike remain constant for the duration of the week until the next update the following week.
7. Due to the current systems limitations, each volatility skew captured for each bond future contract, for each expiry, comprises only 9 data points (four points either side of the ATM strike). The current process captures intervals of **0.25%** for the 9 yield strikes. Below is an illustration of one such skew for the R2030 contract:

DATE :	**14-Oct-2020**				
CONTRACT	**2030**				
EXPIRY	**05-Nov-2020**				
VALUATION DATE	**10-Nov-2020**			**Moneyness**	**Relative/Floating Vol**
LOWEST STRIKE	**8.500**	**VOL**	**11.93**	**89.47%**	**-0.76**
STRIKE	**8.750**	**VOL**	**11.98**	**92.11%**	**-0.71**
STRIKE	**9.000**	**VOL**	**12.19**	**94.74%**	**-0.50**
STRIKE	**9.250**	**VOL**	**12.47**	**97.37%**	**-0.22**
STRIKE	**9.500**	**VOL**	**12.69**	**100.00%**	**0.00**
STRIKE	**9.750**	**VOL**	**12.94**	**102.63%**	**0.25**
STRIKE	**10.000**	**VOL**	**13.31**	**105.26%**	**0.62**
STRIKE	**10.250**	**VOL**	**13.71**	**107.89%**	**1.02**
HIGHEST STRIKE	**10.500**	**VOL**	**14.10**	**110.53%**	**1.41**
FUTURE PRICE	**9.500**				2.17
BASE VOLATILITY	**12.69**				
MAX VOLATILITY	**40.00**				
MIN VOLATILITY	**0.10**				

3. PROPOSED METHODOLOGY AND PROCESS

The proposed methodology changes include changing the metric used for mapping from swaps to bonds and updating the volatilities more frequently.

1. The metric used for mapping swaps to bonds will be changed from the PV01 to the **Term to Maturity.**
   a. The remaining term to maturity is calculated for each bond option expiry for the underlying bond instrument.
   b. Each **bond option expiry** is then mapped to the corresponding **swaption tenor** and also the underlying bond's remaining term to maturity mapped to the corresponding underlying swap tenor.
   c. Linear interpolation will be applied to estimate the yield volatility skew for the bond option expiry in question
   d. The yield intervals of 0.25% that capture the moneyness on the skew, will be altered in order to capture a broader range of strikes. For traded strikes that occur in between the intervals, a liner interpolation is carried out in MTM process to calculate the implied volatility applicable to that strike. The intervals that will be implemented will be as follows:

Current Yield Intervals	New Yield Intervals
-1.00%	-2.00%
-0.75%	-1.00%
-0.50%	-0.50%
-0.25%	-0.25%
ATM	ATM
+0.25%	+0.25%
+0.50%	+0.50%
+0.75%	+1.00%
+1.00%	+2.00%

   These intervals will be observed from time to time for their appropriateness as market conditions change. Any changes that the JSE makes will be communicated to the broader market.

2. The process will be run daily to ensure capturing the actual market experience.

4. TIMELINES

The updated process will go live from **2 November 2020**. The JSE welcomes any other feedback given between now and the date the process is implemented.

Should you have any queries regarding this notice, please contact valuations@jse.co.za

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