

02 June 2013

Interest Rate Derivatives

Determining the Mark-to-Market (M-T-M) levels for Bond Options

The points below summarise the pertinent points from numerous consultations with market participants in the listed and OTC bond options market since the 22nd November 2011 to date. The balance of the document describes the principles and processes for calculating Mark-to-Market results for bond options. The principles and processes detailed in this document are subject to change and improvement through continuing consultations with participants:

- 1) The ZAR Jibar swaption volatilities and skews will be used as the base. The market makers find it much more beneficial to contribute this information, as they have Interest Rate Derivative desks quoting OTC swaptions on a continuous basis. The swaption volatilities submitted by the market-makers are compared to other sources on Reuters/ Bloomberg to ensure they are market related.
- 2) This swaption volatility surface is interpolated (on a duration basis) to obtain the “par” yield volatilities for each bond, which are then converted to price volatilities using the standard duration-adjusted formula. This process and conversion assumes:
- 3) The bond in question is trading at par
- 4) There is a 100% correlation between the bond and the Jibar yield curves

The above process results in an At-The-Money (ATM) volatility(vol) and skew for each bond in the MTM process.

Calibration

- 1) The ATM bond option volatilities will be calibrated weekly, **together** with contributed skews, every Wednesday.
- 2) Should a public holiday fall on a Wednesday, the modified following business day convention will be used.
- 3) In addition an ATM and volatility skew update will be done on the last working day of each month.
- 4) The following steps are followed:

Step 1: When converting from a swaption yield volatility to a bond option all-in price volatility, the JSE uses the most recent swap curve, and the most recent bond future MTM levels. In order to make the process of contributing as simple as possible, the JSE has created a template for each contributor.



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Each week, this template is updated with each contributor's most recent contribution, as well as the most recent JSE swap curve, and includes the most recent bond future MTM levels.

Step 2: The JSE sends out the updated template by 07h30, on the morning of the calibration requesting that all contributors update their relevant swaption yield volatilities.

Step 3: The template below is an example of what is distributed to each of the contributors, which is always populated with the previous week's quotes given to the exchange by the respective contributors. Each contributor can manually override the formulas used to derive the price volatilities, in order to obtain the preferred levels. The final quotes by the contributors are sent back to the exchange by 09h30 each Wednesday. Should the JSE not receive a contribution by 09h30, then the JSE will then automatically exclude that contributor's level for that specific week in mention, unless the JSE is advised to use the same levels submitted in the previous week's calibration.

Swaption Yield Vols: ATM-100							
Expiry / Tenor	1y	2y	3y	4y	5y	7y	10y
2013/05/02	9.75%	13.25%	14.75%	16.75%	17.75%	18.50%	18.50%
2013/08/01	11.25%	14.25%	15.25%	16.75%	19.25%	20.50%	22.25%
2013/11/07	13.80%	16.80%	16.80%	17.80%	19.80%	20.55%	22.30%
2014/02/06	14.30%	17.30%	17.30%	18.30%	20.30%	20.55%	20.05%
Swaption Yield Vols: ATM							
Expiry / Tenor	1y	2y	3y	4y	5y	7y	10y
2013/05/02	10.50%	14.00%	15.50%	17.50%	18.50%	19.25%	19.25%
2013/08/01	12.00%	15.00%	16.00%	17.50%	20.00%	21.25%	23.00%
2013/11/07	14.50%	17.50%	17.50%	18.50%	20.50%	21.25%	23.00%
2014/02/06	15.00%	18.00%	18.00%	19.00%	21.00%	21.25%	20.75%
Swaption Yield Vols: ATM+100							
Expiry / Tenor	1y	2y	3y	4y	5y	7y	10y
2013/05/02	11.60%	15.10%	16.60%	18.60%	19.60%	20.35%	20.35%
2013/08/01	13.10%	16.10%	17.10%	18.60%	21.10%	22.35%	24.10%
2013/11/07	16.20%	19.20%	19.20%	20.20%	22.20%	22.95%	24.70%
2014/02/06	16.70%	19.70%	19.70%	20.70%	22.70%	22.95%	22.45%

Step 4: By updating the above, each contributor can immediately see the bond option yield and all-in price volatilities associated with the contributed swaption yield volatilities.

2013/05/02	Strike			Yield Vol			Price Vol		
Bond/Moneyness	80%	100%	120%	80%	100%	120%	80%	100%	120%
R206	4.3	5.5	6.5	9.75%	10.50%	11.60%	0.34%	0.37%	0.41%
R201	4.3	5.3	6.5	11.76%	12.51%	13.61%	0.92%	0.98%	1.06%
R157	4.5	5.5	6.5	14.00%	14.75%	15.85%	1.56%	1.65%	1.77%
R203	4.8	6.0	7.0	17.20%	17.95%	19.05%	3.69%	3.85%	4.09%
R204	5.0	6.3	7.5	18.06%	18.81%	19.91%	4.93%	5.13%	5.43%
R207	5.3	6.5	7.8	18.40%	19.15%	20.25%	6.09%	6.34%	6.71%
R208	5.3	6.5	7.8	18.50%	19.25%	20.35%	7.27%	7.56%	7.99%
R2023	5.5	6.8	8.3	18.50%	19.25%	20.35%	8.62%	8.97%	9.49%
R186	6.0	7.5	9.0	18.50%	19.25%	20.35%	10.51%	10.93%	11.56%
R213	6.3	8.0	9.5	18.50%	19.25%	20.35%	14.03%	14.60%	15.44%
R209	6.5	8.3	9.8	18.50%	19.25%	20.35%	16.30%	16.96%	17.93%
R214	6.5	8.3	10.0	18.50%	19.25%	20.35%	16.98%	17.67%	18.68%

Step 5: The exchange will also gather ATMs swaption volatilities from third party providers. The exchange acquires the third party providers information off the updated quotes. The exchange acquires updated quotes from third party providers by extracting their updated file on each Wednesday morning from either Bloomberg or Reuters.

Step 6: The implied ATM all-in price volatilities of all contributors are then averaged by the JSE as follows:

- 1) Calculate all-in price volatility for each ATM bond option for an equally weighted average.
- 2) Calculate all-in price volatility for each ATM bond options for the open interest average.
- 3) The MTM volatility for each ATM bond option is then obtained by assigning a 40% weighting to the ATM volatility derived in I above and 60% weighting to the ATM volatility determined from II above.
- 4) No member can have an open interest of greater than 50%.

The example below illustrates how the weighting for the open interest average is calculated:

- Contributor A: ATM Volatility contribution of 7%
- Contributor B: ATM Volatility contribution of 7.5%
- Contributor C: ATM Volatility contribution of 8%
- Contributor D: ATM Volatility contribution of 8.25%

Assume that contributor C holds 100% of the open interest. We would derive our ATM volatility as follows:

$$\begin{aligned}
 ATM\ Vol &= 0.4 \left(\frac{7\% + 7.5\% + 8\% + 8.25\%}{4} \right) \\
 &\quad + 0.6([7\% \times 0\%] + [7.5\% + 0\%] + [8\% \times 100\%] + [8.25\% \times 0\%]) \\
 &= 7.805\%
 \end{aligned}$$

The skew is determined using a similar approach.

Step 7: The JSE then sends the contributors the excel file showing the new skew and surface, together with the previous week's skew and surface. The email containing this information also shows a summary of the changes in the ATM levels (per expiry and future) as follows:

new		old		
2013/05/02		2013/05/02		
Bond/Moneyness	100%	Bond/Moneyness	100%	changes
R206	0.41%	R206	0.41%	0.00%
R201	1.05%	R201	1.04%	0.01%
R157	1.74%	R157	1.72%	0.02%
R203	3.96%	R203	3.93%	0.03%
R204	5.12%	R204	5.16%	-0.04%
R207	6.19%	R207	6.27%	-0.08%
R208	7.33%	R208	7.36%	-0.04%
R2023	8.45%	R2023	8.42%	0.03%
R186	10.46%	R186	10.48%	-0.02%
R213	13.76%	R213	13.74%	0.02%
R209	16.19%	R209	16.20%	-0.01%
R214	16.63%	R214	16.55%	0.07%

Step 8: The JSE will update the ATM and skew levels internally by 13h00 every Wednesday.

Step 9: The JSE sends the final skew and the ATM levels to the market by no later than 14h00 on the same day. The new levels will also be available on the JSE website at the following FTP link http://www.jse.co.za/DownloadFiles.aspx?RequestedNode=DownloadableDocuments/YieldX/IRD_Vol_Skews as well as on the JSE website at the following link <http://www.jse.co.za/Markets/Interest-Rate-Market/Initial-margin-volatility-skew.aspx> by no later than 16h00.

Rules & Principles for Contributing to the Volatility Calibration Process

- 1) The updated skews and ATM must be sent to the exchange each Wednesday.
- 2) If the swaption contributions sent to the exchange are 3 yield volatilities away from the median, it will be excluded from the calculations as it could negatively influence that week's volatilities.
- 3) NO member can hold more than 50% open interest of the entire market at any point in time.

Who Qualifies to Contribute

- 1) All members of the exchange namely banks, brokers, inter-dealer brokers and institutions.
- 2) The exchange will also accept third party providers of skews or ATM levels as they act impartially in the market and provide essential mid volatilities in order for the exchange to provide impartial MTM levels.
- 3) Members must contribute skews and ATM levels for the entire curve.
- 4) Members have to show/indicate 2-way volatility prices (parties that have a bias towards pricing on one side will be unacceptable).
- 5) Any new participants wishing to contribute must provide their relevant contributions to the exchange for at least 4 weeks continuously.

- 6) Contributions from new participants will be tested to ensure that they do not materially affect the current skews in order to minimise potential negative consequences for the market.
- 7) All contributors have to commit to making continuous weekly skews. This is to prevent once off or infrequent contributions that can introduce volatility to the process.
- 8) End user clients who are not members of the exchange can contribute to their skew information via an existing member.

Current Providers of Volatilities & Skews to The Exchange

- 1) Prescient Securities
- 2) Rand Merchant Bank
- 3) Standard Bank
- 4) Protocol

Ad-Hoc Calibrations

The exchange and the contributors will consider making ad-hoc changes to the volatility skews and ATM volatilities when there are material changes in market conditions, or when there are large volumes of trade activity occurring that could have adverse impacts on where trades are taking place and where MTM levels are set.

The JSE will update the ATM volatilities on an ad-hoc basis, in one of the following situations:

- 1) The member requesting the update is required to hold at least 20% of all the bond options open interest held at the exchange, or alternatively, the member's potential trade needs to constitute 20% of the future open interest of the bond options market. The member's position can be held in various client accounts as long as the over-all position of the member represents at least 20% of the open interest of the entire bond options market.
- 2) Two or more volatility skew contributors approach the JSE to request a new ATM update.
- 3) The JSE reserves the right to not perform an ad-hoc skew calibration. The member needs to approach the JSE on behalf of their clients should any ad-hoc requests be made.
- 4) An ad-hoc skew calibration will only be done using new ATM levels (i.e. the skew will be unchanged from the previous week).
- 5) To perform an ad-hoc skew calibration, the JSE will need to be advised of an ad hoc volatility skew request by 15h00 on the previous business day prior to the new calibration. Thus, the exchange will not be able to perform an ad-hoc ATM update on the same day as the request.
- 6) The JSE will request new ATM levels from all contributors, and will not perform any updates before receiving feedback from all contributors.
- 7) All contributions need to be submitted by 09h30
- 8) Should the JSE not receive an ATM contribution by 09h30, the JSE will assume that a contributor has left their ATM levels unchanged, and use the contributor's previous contributions.
- 9) The results of any ad-hoc volatility update is final and will not be amended.

What Constitutes a Material Change

The transparency on MTM levels in the bond options market is relatively opaque so it may be necessary to implement an ad-hoc change based on evidence of material changes in key market variables or trading volumes that are deemed to be contributing drivers to the MTM levels on bond options also changing materially, for example;

- 1) Large trades in excess of 2,500 contracts or R250m nominal.
- 2) When the level of the Rand versus the US Dollar or Euro increases or decreases by more than 3% on any given day or 5% over 2 or more days.
- 3) When bond yields change by more than 15 basis points on any given day or 25 basis points over 2 or more days. This is a particularly relevant event over MPC meeting dates.

Please do not hesitate to contact the JSE Interest Rate Derivatives team should you require any further information. For further information contact the Interest Rate Derivatives team on ird@jse.co.za