ANNEXURE E

JSE | CLEAR

SWAP FUTURES: INITIAL MARGIN METHODOLOGY

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1. Introduction

JSE Clear currently makes use of a simplistic portfolio scanning methodology (J-SPAN) to determine the amount of initial margin that participants must pledge against exposures in exchange traded derivative contracts. The simplistic nature of the J-SPAN framework often implies a lack of initial margin offset between highly correlated contracts. This is particularly problematic in the interest rate swap market, where portfolios often comprise of long and short exposures across the entire curve. To this end, the JSE proposes the use of an alternative framework (to J-SPAN) for the purpose of calculating portfolio-level initial margin requirements, for portfolios containing interest rate swap futures[1]. The purpose of this document is to describe the details surrounding this alternative framework.

2. Swap Futures

Swap futures are designed to replicate the daily cash flows of a cleared, OTC interest rate swap, from the point of listing to the maturity date of the underlying swap. Standardization is achieved as follows:

- Only a standard set of tenors are considered;
- New contracts are listed on a quarterly basis; and
- A standard day count convention, roll convention, business day convention, floating rate index, floating rate tenor, and business calendar is used for all futures.

At maturity, the value of an interest rate swap futures contract, V_T, is as follows:

$$V_T = 100 + \sum A_T - \sum PAI_T,$$

where $\sum A_T$ is the sum of the sum of the net coupon payments that occurred throughout the life of the underlying swap, and $\sum PAI_T$ represents the sum of the daily Price Alignment Interest (PAI) payments that occurred throughout the life of the swap. The PAI_t on a particular day represents the interest payment associated with funding the Net Present Value (NPV_{t-1}) of the underlying swap at the previous Mark-to-Market (MtM).

The value of a swap futures contract prior to expiry is:

$$V_t = 100 + NPV_t + \sum A_t - \sum PAI_t,$$

where NPV_t is calculating by projecting future float rate cash flows off the ZAR JIBAR swap curve, and discounting all expected future cash-flows payments off the ZAR JIBAR swap curve (in the absence of an observable ZAR OIS Curve).

[1] The JSE intends to list swap futures contracts towards the latter end of Q3 2015.

Initial margin should cover the extent to which V_t can change over an assumed liquidation period.

3. The VaR Framework

The following framework is used to determine contract level initial margin requirements across all of the derivatives markets operated by JSE Clear:

VaR Methodology	Confidence Interval	Liquidation Period	Look-Back Period
HistVaR	99.7%	At least 2-days	Rolling 750-day plus stressed 250-day

It should be noted that the above framework was approved after extensive research and market engagement. It is proposed that this same framework be extended to a portfolio level framework for the swap futures product suite. For the remainder of this paper, the term "portfolio" will be used to refer to the entire set of positions that reside in a particular JSE Clear account.

The initial margin calculation for a particular portfolio will thus involve:

1. Performing the J-SPAN calculation on all contracts excluding swap futures;
2. Performing the portfolio level HistVaR calculation across all swap futures; and finally
3. Adding the results from steps to 1 and 2 to obtain a portfolio level initial margin requirement.

The portfolio level HistVaR calculation will involve (step 2 above):

- Obtaining the relative 2-day shifts in the ZAR zero coupon JIBAR swap curve associated with each day in the look-back period;
- Applying these 2-day curve shifts to the most recent ZAR JIBAR swap curve in order to obtain a set of hypothetical zero-coupon ZAR swap curves for T+2;
- Revaluing each swap futures contract under the hypothetical set of curves for T+2;
- Calculating the profit and loss (P&L) for each future under each hypothetical curve;
- Aggregating the contract-level P&L's in order to obtain the portfolio-level P&L associated with each hypothetical curve. The portfolio-level P&L vector is then the vector where element $\boldsymbol{i}$ represents the portfolio-level P&L associated with hypothetical curve $\boldsymbol{i}$, i.e. the P&L associate with the relative curve shift that occurred on day $\boldsymbol{i}$ in the look-back period; and finally
- Calculating the 99.7th percentile of the portfolio-level P&L vector.

4. Liquidation "Add-Ons"

A key component of an initial margin methodology is its ability to incorporate the costs associated with liquidating a defaulting portfolio. To this end, the account-level initial margin methodology for swap futures should apply a more punitive initial margin requirement (in relative terms) for large positions than for small positions, in order to acknowledge the higher liquidation costs typically associated with large positions. This cost includes the cost of the bid/offer spread which is not incorporated in VaR based on mid-to-mid market moves.

In order to incorporate the costs associated with liquidating a defaulting portfolio, it is proposed that the following algorithm be applied to the portfolio level IM calculation for each portfolio containing swap futures:

- After completion of the portfolio VaR calculation, determine the change in the value of each portfolio associated with:
    - Bumping the Mark-to-Market (MtM) value of the first input to the swap curve up by one basis point, and reconstructing the entire swap curve whilst leaving all other inputs unchanged.
    - Repeating the above for each input to the swap curve recursively.
- The above step will create a so-called PV01 ladder for each portfolio. The $\boldsymbol{i^{th}}$ "step" of the PV01 ladder for a particular portfolio represents the change in the MtM of the portfolio associated with a one basis point change in the value of the $\boldsymbol{i^{th}}$ input to the curve.
- Each "step" of each PV01 ladder should then be multiplied by the corresponding element in so-called hedge cost matrix, in order to determine the liquidation "add-on" due to each input to the curve. Element $(\boldsymbol{i}, \boldsymbol{j})$ of the hedge cost matrix represents the basis point cost typically associated with executing a trade with a PV01 of $\boldsymbol{j}$, in the $\boldsymbol{i^{th}}$ curve input. The elements of the hedge cost matrix will be determined through market consultation.
- Finally, the portfolio level liquidation "add-on" is determined by adding the portfolio level liquidation "add-ons" per curve input.

It should be noted that liquidation "add-ons" will form part of the portfolio level initial margin, and will be treated as such in the JSE Clear rules and directives.

Example:

Assume the PV01 ladder for a particular portfolio is as follows (please note that actual an actual PV01 ladder will be more granular in terms of the number of curve points):

Curve Input	PV01 (Mn)
3x6 FRA	0.1
6x9 FRA	0.15
9x12 FRA	(0.2)
2 Year Swap	(1)
5 Year Swap	(0.4)
10 Year Swap	4

Table 1: Example of a portfolio level PV01 ladder.

Assume the hedge cost matrix is as per the below (please note that an actual hedge cost matrix will be more granular in terms of the number of curve points, and the number of PV01 buckets):

Curve Input	PV01 (Mn) Bucket			
	(∞)-(0.5)	(0.5)-(0.0)	0.0-0.5	0.5-∞
3x6 FRA	10	5	5	10
6x9 FRA	10	5	5	10
9x12 FRA	10	5	5	10
2 Year Swap	10	5	5	10
5 Year Swap	10	5	5	10
10 Year Swap	10	5	5	10

Table 2: Example of a hedge cost matrix.

The concentration charges for the particular portfolio will then be as follows:

Curve Input	Liquidation Charges (R Mn)
3x6 FRA	0.1x5 = 0.5
6x9 FRA	0.15x5 = 0.75
9x12 FRA	0.2x5 = 1
2 Year Swap	1x5 = 5
5 Year Swap	0.4x5 = 2
10 Year Swap	4x10 = 40

The total concentration charges (to be applied as a portion of the portfolio level IM) will be equal to R 49.25 million.

5. Practical Considerations

In order to minimize the operational risk faced by JSE Clear, and in an effort the keep portfolio-level initial margin requirements as stable and transparent as possible, it is proposed that:

- Contract-level P&L vectors get updated on a scheduled weekly basis instead of daily. In particular, contract-level P&L vectors should get updated on the first day of any given week;
- JSE Clear will perform ad-hoc P&L vector recalculations should market circumstances warrant such a recalculation;
- The contract level P&L scenarios used to calculate PV01 ladders will be updated when, and only when contract-level P&L vectors are updated;
- Hedge costs matrices will be updated from time to time at the discretion of the JSE;
- The JSE will publish the production version of the P&L vector, the P&L scenarios used to calculate PV01 ladders, and the hedge cost matrix on its website.