LCH.CLEARNET

Risk Awards 2015

Derivatives Initial Margin Enhancements

12 of May 2015

Subject to Regulatory Approval

Agenda

1. Risk Management Overview

2. Derivatives Initial Margin Enhancements – One-factor model

3. Evolution of Index pricing model

4. Evolution of Equity pricing model

5. Parameters Files

Risk Management Overview

Risk Management Overview

Derivatives Initial Margin Enhancements

Overview

- *LCH.Clearnet SA introduces the planned enhancements to its risk model on Initial Margin calculation for Financial Derivatives (subject to regulatory approval);*

- *The current Initial Margin algorithm is based on the portfolio residual balance liquidation according to various scenarios representing changes in market conditions;*

- *LCH.Clearnet SA uses SPAN® to perform Initial Margins calculations;*

- ***Scope: Financial Derivatives***

- ***Target:***
  - ✓ ***Improvement of the inter-commodity spread credits (offsets)***
  - ✓ ***Improvement of portfolio margining efficiency particularly for single stocks derivatives***
  - ✓ ***Other improvements to the Initial Margin framework***

- ***Implementation date – November 2015***

Enhancements to Financial Derivatives Initial Margin calculation

1. *Introduction of one-factor model for Inter-commodity spread credits*
2. *Evolution of Index pricing model*
3. *Evolution of Equity pricing model*

➢ ***LCH.Clearnet SA provides Members with parameter files to duplicate the algorithms***

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Risk Management Overview

Derivatives Initial Margin Enhancements

Benefits

- *Improvements will lead to portfolio margining efficiencies – on average, the Initial Margin requirement decreases on Financial Derivatives while complying with the high risk standards policy of LCH.Clearnet SA:*

  ✓ *Introduction of a one-factor model for inter-commodity spread credits*

  ✓ *Introduction of offsets between single stock derivatives and therefore increased portfolio margining efficiencies*

Changes

1) *New "Lambda parameter file " with two additional parameters will be provided to Members*

2) *Additional values will be displayed in the existing fields of the SPAN® parameter file*
   - ✓ *There is no change in the layout*

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Derivatives Initial Margin Enhancements
One-factor model

SPAN® Enhancements

Inter-commodity spread credits

SPAN® Enhancements: Inter-commodity spread credits

Concept:

- *To enhance the offsets performance LCH.Clearnet SA introduces the one-factor model:*
  All Combined Commodities are correlated to a single general risk factor ("the market") to a certain extent

- *This correlation will take the form of two parameters:*
  - ✓*"max correlation", so-called "λmax"*
  - ✓*"min correlation" , so-called "λmin"*

*defined at Combined Commodity level**

**Combined Commodity is a set of contracts having the same underlying instrument.*

- *The calculation will be displayed :*
  - ✓ *using Scan Range aggregation on the CC (Combined Commodity) level*
  - ✓ *using the Lambdas instead of existing inter-commodity spread credits on the portfolio level*

Changes

- Creation of "Lambda parameter file"

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SPAN® Enhancements

Inter-commodity spread credits

Calculation steps in SPAN® environment

- Step 1: For each of the SPAN® result scenarios (*16 in the current algorithm*) and for each combined commodity (*with "on"/"Yes" indicator provided in "Lambda parameter file" in "Lambda Activation" column*), evaluate the General Risk ***(GR)*** of the scenarios ***(RA)**** with $\lambda_{\max}$ parameters:

$$GR^{CC}_{scenario\ \ i,\lambda_{\max}} = \lambda_{\max} \times RA^{CC}_{scenario\ \ i}$$

- Step 2: Sum the general risk component over all combined commodities to get the General Risk for each SPAN® scenario, at portfolio level (Margin Account):

$$GR_{scenario\ \ i,\lambda_{\max}} = \sum_{AllCC} GR^{CC}_{scenario\ \ i,\lambda_{\max}}$$

- Step 3: Take the maximum among the 16 scenarios to get the final $GR_{\lambda_{\max}}$

$$GR_{\lambda_{\max}} = \max_i \left\{ GR_{scenario\ \ i,\lambda_{\max}} \right\}$$

- Step 4: Take the square of the result

$$FinalGR_{\lambda_{\max}} = \left(GR_{\lambda_{\max}} \right)^2$$

- Step 5: At result Risk Array level for a CC, take the worst of all scenarios ***WS***. As a positive risk array is a loss it leads to:

$$WS_{CC,\ \ \lambda_{\max}} = \max_i \left\{ RA^{CC}_{scenario\ \ i}, 0 \right\}$$

- Step 6: For each Combined Commodity, consider the residuals (idiosyncratic risks, ***IR***) as:

$$IR_{CC,\ \ \lambda_{\max}} = \left(1 - \lambda^{CC\,2}_{\max} \right) \times WS^2_{CC,\ \ \lambda_{\max}}$$

***** ***Risk Arrays give the theoretical future loss/gain of a derivatives contract for the market scenarios. The Scanning Risk calculation is provided on the page 15 at SPAN(R) Derivatives Brochure***

Calculation steps in SPAN® environment

- Step 7: Sum the results on all Combined Commodities:

$$IR_{\lambda_{\max}} = \sum_{AllCC} IR_{CC,\lambda_{\max}}$$

- Step 8: The $\lambda_{\max}$ margin requirement after offsets for the set of upward correlation parameters is:

$$SRO_{\lambda_{\max}} = \sqrt{IR_{\lambda_{\max}} + FinalGR_{\lambda_{\max}}}$$

- Step 9: Perform the same calculation from step 1 to step 8, for the set of $\lambda_{\min}$ parameters to compute $SRO_{\lambda_{\max}}$

- Step 10: Take the maximum of the two results

$$SRO = \max\left\{SRO_{\lambda_{\max}}; SRO_{\lambda_{\min}}\right\}$$

- Step 11: Compare the Scan Risk at portfolio level for all CC to the resulting Scan Risk after Offset (SRO) calculated at step 10. Find the total offset percentage, ***k.*** This amount is by construction supposed to range from 0 to 1.
- ***k*** is capped at 80% as per EMIR requirement (this is a parameter) depending on regulatory recommendations

$$k = Min\left(1 - \frac{SRO}{ScanRisk^{AllCCon}}; 80\%\right)$$

- for each combined commodity eligible to the offsets, replace the Inter-Commodity offset (ICO) field by:

$$ICO^{CC} = k \times ScanRisk^{CC}$$

- Perform the remaining calculation as usual to derive the margin requirement

Evolution of Index pricing model

Evolution of Index pricing model

Financial Derivatives

Index pricing model

- ***Concept:***

  - ✓*Use of the Future prices in the Index Options valuation formula*

  - ✓*For Index options the Future price corresponding to the same maturity will be used:*

    - ○ *if the future's and the option's maturities are the same*

    - ○ *otherwise, if the corresponding maturity does not exist, the model computes the theoretical future from the Parity Call-Put or linear interpolation.*

Changes

- The SPAN® parameter file will display additional values in the following records:
  - ✓ Record 4B: array calculation parameters
  - ✓ Records 81, 82, 83

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Evolution of Equity pricing model

Evolution of Equity pricing model

Financial Derivatives

Equity pricing model

- ***Concept:***

  ✓*Improvements to the Cox Ross Rubinstein (CRR) pricing model*

  ✓*Inclusion of dividend in the node value instead of the probability in the CRR model*

Changes

- No technical impacts on reports or parameters files
- The enhancement to the Equity pricing model will be displayed on the website:

  SA Derivatives Margin Methodology in “Option Valuation Formula” section

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Parameters files

Parameters files

Updated documents for Members

Technical documentation provided to Members

- Technical documentation for Members:
  On the Secure Area at **LCH.Clearnet Secure Area**
  - in « Clearing Specifications » section – “Members reports for the derivatives markets” document;
  - in « SPAN® » section – « SPAN® parameter public file »;

- Risk Parameters Files for Members:
  On LCH.Clearnet SA website at **Cash & Derivatives Public Files**
  - in « Risk Parameters Files LCH.Clearnet SA » section;
  - in « SPAN® Files LCH.Clearnet SA » section – « SPAN® parameter file »;
  - in « Lambda Files LCH.Clearnet SA » section – « Lambda parameter file »;

- The derivative markets member reports are made available to members via LCAPs and eCCW®

Parameters files

1. Lambda parameter file

Parameter files

1) « Lambda parameter file »
2) Updated « SPAN® parameter public file »

1. Lambda parameter file

✓ *The "Lambda parameter file" contains the following data:*

- ✓*Combined Commodity code*
- ✓*λacv, "activation indicator"*
- ✓*λmin, "Lambda min correlation"*
- ✓*λmax, "Lambda max correlation"*

Combined Commodity	Lambda Activation	Lambda Min	Lambda Max
FCE	Y	0,80	1,00
AEX	N	0,80	0,94
BXF	Y	0,80	0,92
AI	N	0,80	0,89
CS	Y	0,79	0,88
SU	N	0,79	0,88
BNP	Y	0,75	0,85
FP	N	0,73	0,84
SGO	Y	0,73	0,84
GLE	N	0,72	0,83
GAZ	Y	0,71	0,83
DG	N	0,69	0,81
CA	Y	0,68	0,81
OR	N	0,67	0,80

Parameters files

2. Updated SPAN® parameter public file

2. SPAN® parameter file will display additional values in the following records

- ✓ *Record 4B with new FUT synthetic with a maturity linked to the option OOP*
- ✓ *Records 81 ,82, 83 will be created with the new synthetic FUT with corresponding maturity*

Record 4B

Records 81,82,83

```
O MONEP 20141111SF     20141111190SUPNNXMRGN      C CUST  H HEDGE 1 CORE  M MAINT
1 MNP  MP
P MNPAEX.IND      PHY  AEX.IND         007000  00000010000000000000000001EURESTD    PAUEQTY
P MNPAEX          OOP  AEX             007007  000010000000000000000000001EURESTDEUROPAUEQTY
2 MNP AEX   OEUREPN   SAEX.IND     PHY  000000000000010 AEX          OOP  000000000001000
3 AEX   1001201411201401122014122015060320150920150904206412206412  100031000310003
C AEX   1001020000004010101B020101A
C AEX   1002020000012010101A020201B
C AEX   1003020000036010301A020401B
C AEX   1004020000037010201A020301B
C AEX   1005020000037010201A020401B
C AEX   1006020000038010101A020301B
C AEX   1007020000038010101A020401B
4 AEX   01                                                  0000052100210022
B MNPAEX.IND      PHY  206412          000000000030000007000270020200030350040000000000000000027450100003        AEX.IND       000000
B MNPAEX.IND      PHY  201411          000000000030000007000270020200030350040000000000000000027450100003        AEX.IND       000000
B MNPAEX.IND      PHY  201412          000000000030000007000270020200030350040000000000000000027450100003        AEX.IND       000000
B MNPAEX          OOP  201411  201411  000000000030000007000270020200030350040000540002740500027450100003201411121AEX.IND     76000000
B MNPAEX          OOP  201412  201412  000000000030000007000270020200030350040000840010411500027450100003201412219AEX.IND     76000000
5 INDEX       AEX
81MNPAEX.IND      AEX.IND      PHY   206412          000000000000000020000000+00000000+00000900-00000900-00000900+00000900+00001800-
82MNPAEX.IND      AEX.IND      PHY   206412          000000000000000020000180O-00001800+00001800+00002700-00002700-00002700+00002700+
83MNPAEX.IND      AEX.IND      PHY   206412          000000000000000020000189O-00001890+10000+4000000000000315180000O+700000000010
81MNPAEX.IND      AEX.IND      PHY   201411          000000000000000020000000+00000000+00000900-00000900-00000900+00000900+00001800-
82MNPAEX.IND      AEX.IND      PHY   201411          000000000000000020000180O-00001800+00001800+00002700-00002700-00002700+00002700+
83MNPAEX.IND      AEX.IND      PHY   201411          000000000000000020000189O-00001890+10000+4000000000000315180000O+700000000010
81MNPAEX.IND      AEX.IND      PHY   201412          000000000000000020000000+00000000+00000900-00000900-00000900+00000900+00001800-
82MNPAEX.IND      AEX.IND      PHY   201412          000000000000000020000180O-00001800+00001800+00002700-00002700-00002700+00002700+
83MNPAEX.IND      AEX.IND      PHY   201412          000000000000000020000189O-00001890+10000+4000000000000215180000O+700000000010
81MNPAEX          AEX.IND      OOP  C201411  201411  000024000000007200010376-00009778-00100200-00099777-00079377+00080220+00190074-
82MNPAEX          AEX.IND      OOP  C201411  201411  000024000000007200189776-00169032+00170219+00279984-00279775-00258552+00260218+
83MNPAEX          AEX.IND      OOP  C201411  201411  000024000000007200192420-00185378+09998+4098206007000017420000O0+7000000001000
81MNPAEX          AEX.IND      OOP  P201411  201411  00002400000000720000498-00000100+00000322-00000100+00000744-00000100+00000198-
82MNPAEX          AEX.IND      OOP  P201411  201411  000024000000007200000100+00001087-00000100+00000109-00000100+00001566-00000100+
83MNPAEX          AEX.IND      OOP  P201411  201411  00002400000000720000035+00000162-00001-4098206007000000000100000+7000000001000
```

- *LCH.Clearnet SA creates a synthetic future with the same maturity date of the option*

Warning**: **These records will be impacted by other projects

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