

**Appendix A**

**Counterparty Risk Treatment of  
OTC Derivatives and Securities  
Financing Transactions**

**June 2003**

**ISDA – TBMA - LIBA**

## Introduction and background :

ISDA advocated the adoption of a new regulatory measure of future exposure (expected positive exposure-EPE) for OTC derivatives<sup>1</sup> in its response to the Committee's second consultation paper on the Capital Accord reform, dated May 2001<sup>2</sup>. Active dialogue followed with the Models Task Force (MTF), in the course of which ISDA provided further information on the treatment of wrong way risk and EPE validation<sup>3</sup>. We also agreed to conduct a Counterparty Risk Survey aiming at assessing the use of EPE in firms' internal economic capital models.

We were pleased to see that the Federal Reserve Board<sup>4</sup> had taken an interest in the theoretical parts of our 2001 proposal and sought to analyse the impact of relaxing the key assumptions we had made, in particular the appropriateness of postulating weak independence of exposures between counterparties. ISDA has undertaken additional research on the effect of granularity and exposure correlation on capital.

The purpose of the following document is to update the MTF on work conducted in the ISDA Counterparty Risk Working Group (CRWG) over the past eighteen months, including the research and Counterparty Risk Survey mentioned above.

We have organised the paper around six themes, most of which are raised in the FRB research paper :

- I- Industry counterparty exposure measurement practice
- II- Wrong way exposure
- III- The effect of granularity and exposure correlation on capital
- IV- Time horizon and maturity
- V- Treatment of collateralised OTC derivatives and securities financing transactions
- VI- Validation of EPE-based measures of future exposure

We understand that the MTF intends to review the capital treatment of counterparty risk soon after the adoption of the New Accord, with a view to implementing any necessary changes at the same time as the Accord itself. ISDA strongly supports this stance, and hopes that the information contained in this paper will assist the Task Force in achieving its objective.

We furthermore wish to reiterate our belief that the counterparty risk treatment of OTC derivatives cannot be reviewed in isolation, and certainly not without considering possible linkages with the treatment of securities financing transactions (such as repo and securities lending transactions). Like many OTC derivative transactions, repo and securities lending transactions involve the transfer of collateral,

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<sup>1</sup> ISDA deliberately excluded credit derivatives from the scope of its 2001 proposal. Credit derivatives were studied separately and ISDA proposed a new set of credit default swap add-ons at Annex 5 of its commentary on the QIS3 Technical Guidance, dated December 20, 2002 –www.isda.org.

<sup>2</sup> ISDA's response to CP2, May 2001 –www.isda.org

<sup>3</sup> Letter to Daniele Nouy, dated August 7, 2001 –www.isda.org

Letter to Richard Gresser, dated September 7, 2001 –www.isda.org

<sup>4</sup> Regulatory capital for counterparty credit risk : A response to ISDA's proposal, by Michael S. Gibson, Federal Reserve Board

and are utilized by market participants for many of the same purposes, in particular to manage risk. As such, transactions are increasingly managed together with OTC derivatives, including under cross product netting arrangements, and should hence be subject to the same review process by the Basel Committee. The London Investment Banking Association and The Bond Market Association, who both endorse this paper, strongly support this view.

## TABLE OF CONTENTS

I - Industry counterparty exposure measurement practice .....	3
II - Wrong way exposure .....	4
III - The effect of granularity and exposure correlation on capital.....	4
Work performed by the CRWG.....	5
Work at the Federal Reserve Board.....	5
Comparison of the approaches.....	6
Conclusions – capital needed for extra risks.....	6
IV – Time horizon and maturity .....	6
Maturity.....	6
Time horizon.....	7
V - Treatment of collateralised OTC derivatives and securities financing transactions	8
Collateralised derivatives.....	8
Securities financing transactions.....	9
VI - Validation of EPE-based measures of future exposure .....	9

### I - Industry counterparty exposure measurement practice

ISDA, TBMA and LIBA have conducted a Counterparty Risk Survey aiming at assessing firms’ internal practices with respect to (i) counterparty risk measurement; (ii) OTC derivatives’ collateralisation and (iii) the degree of exposure correlation between counterparties. The contents of this survey had been discussed and agreed with the Models Task Force before its publication. Our findings are appended at Annex 1, but key messages are highlighted below (Questions 1 and 2) :

- 1- **A majority of respondents use EPE, or EPE based measures of future exposure in order to calculate economic capital.** Some advanced firms use a full joint simulation of market and credit risk factors; this advanced approach does not explicitly require an intermediate measure of exposure or Loan Equivalent Exposure (LEE) but is conceptually consistent with the use of EPE.
- 2- Clearly, the survey only provides a snapshot of industry practices in 2002. ISDA would be pleased to regularly update it should the Models Task Force find it helpful.
- 3- On average **33% of the respondents’ exposure is collateralised, on an upward trend from previous years.** The range of collateral used has broadened, to include investment grade corporate bonds in addition to the more traditional cash/government bonds. It is expected that recognition of a wider range of collateral assets in the New Capital Accord will facilitate the diversification of collateral sources.

## II - Wrong way exposure

ISDA acknowledges the existence of wrong way risk. We had proposed, in a letter to the Models Task Force dated September 7, 2001, to distinguish between two forms of such risk : **specific** wrong way risk, arising for certain types of transactions, which banks occasionally enter into while prudently measuring the transaction's potential exposure; for instance those collateralised by own or related party shares; and **general** wrong way risk, where the credit quality of the counterparty may be correlated with a macro-economic factor impacting on the value of the derivative portfolio itself.

Well managed banks are equipped to identify specific wrong way risk and use worst case exposure value in economic capital calculations for the positions concerned. ISDA would not recommend using expected exposure values where this type of risk is manifest.

We would however contend that general wrong way risk should be assessed via scenario analysis, not under Pillar 1 capital requirements, unless sufficient evidence of such correlation in particular markets is available. ISDA questions the assertion on page 2 of the FRB research piece, according to which "... exposure and default will typically be correlated". We would like to know which empirical data have been used to demonstrate the existence of such correlation.

## III - The effect of granularity and exposure correlation on capital

The CRWG's proposals on Expected Positive Exposure make two key assumptions about the portfolio, namely:

- Infinite granularity;
- Negligible pairwise correlation between counterparty exposures.

When these assumptions are valid, EPE is an appropriate measure of counterparty risk consistent with IRB concepts, but in a real portfolio, finite granularity and the tendency of positions to have non zero pairwise correlations, even if these average to zero, create more risk and mean that the pure calculations of the original proposal will understate risk to some extent.

To quantify understatement and facilitate discussion, the CRWG adopted the symbol  $\alpha$  for the ratio A/ B where:

- A: = 99.9% loss with correlated market positions and stochastic exposures.
- B: = 99.9% loss for a corresponding portfolio with fixed exposures equal to EPE (see Annex 2 for detail on this definition, proposed by Evan Picoult, Citigroup).

Members of the CRWG have worked on quantifying  $\alpha$  for realistic portfolios, using simulation (see Annex 3 for full details) and – with similar results - using an analytic technique (see Annex 4). Independently, analysis by Michael Gibson (FRB) in response to the CRWG proposal, sheds light on the analytic nature of these risks and of  $\alpha$ .

## Work performed by the CRWG

### Simulations

In a memo to the CRWG, Evan Picoult (Citigroup) suggested quantifying any understatement of risk due to missing correlation and granularity. Eduardo Canabarro (Goldman Sachs) undertook the proposed work performing simulations under a variety of scenarios, using a finite portfolio and allowing correlations between market positions to be non zero. Results are presented in terms of  $\alpha$  defined above, and are repeated in full at Annex 3.

Eduardo's results indicated the degree to which understatement of risk occurs when using EPE in a finite portfolio ( $N = 200$  names) and in the presence of correlation between exposures caused by dispersion of correlation between market positions.

The central value obtained for  $\alpha$  in the simulation is **1.09**, for a portfolio representative of a large dealer's.

### Theoretical results

Thereafter, by applying a variant of the granularity adjustment method<sup>5</sup> in connection with the IRB approach, Tom Wilde (CSFB) performed analytic calculations for  $\alpha$ , obtaining good agreement to the simulation results. These results are presented at Annex 4.

### Counterparty Risk Survey (Question 3)

The simulations and theoretical results naturally assume a particular structure of market risk correlations in the test portfolio; essentially, pairwise correlations are assumed to be distributed in the random fashion that would result from random positions being taken in a small number of underlying random variables, where that number of variables is much less than the number of counterparties in the portfolio.

There is insufficient direct evidence to calibrate the effective number of market factors or equivalently, the variability of pairwise correlations in typical portfolios, and accordingly ISDA has presented simulations for a range of possible values for the number of market variables underlying the portfolio.

However, the Counterparty Risk Survey provides strong evidence that correlations within banks' derivative portfolios do, in general, assume the form expected, namely a wide scattering around an average of zero with positive and negative correlations equally likely.

## Work at the Federal Reserve Board

Michael Gibson at the Federal Reserve has provided an extensive review and analysis of ISDA's original proposals. His review includes theoretical calculations which can be used to assess understatement  $U$  of risk arising from using EPE. Moreover, Michael Gibson's  $U$  parameter and ISDA's  $\alpha$  have the simple relation  $\alpha = 1 + U$  and

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<sup>5</sup> The granularity adjustment method in its original context is described in Michael Gordy "A risk factor model foundation for ratings based capital rules", Federal Reserve Board, October 2002.

so are amenable to direct comparison. ISDA has performed this comparison, as detailed in Annex 4 and summarised here.

### Comparison of the approaches

ISDA's key conclusions on our work and its relation to Michael Gibson's analysis are as follows:

- The conceptual approaches in Gibson and ISDA's work are the same, as explained in detail in Annex 4. There is agreement as to the nature of the additional risks and the correct means of quantifying them. Accordingly, ISDA believes there is full agreement on the technical issues involved.
- The key practical difference is that Gibson's results concentrate on correlation, while ISDA's results incorporate additional risk due both to correlation and to finiteness of the portfolio.
- Gibson does not give actual values for understatement  $U$ , although these can be provided based on his approach. Then we find that ISDA's values for  $\alpha$  or equivalently for  $U$ , are larger than those obtained using Gibson's formulae i.e. suggest slightly higher levels of capital may be needed. This is due to the additional concentration risk in a finite portfolio.

### Conclusions – capital needed for extra risks

Based on this work by CRWG members and by the Federal Reserve, and the evidence of the ISDA Counterparty Risk Survey, we can conclude that :

- The type of market value correlation structure typical in a bank portfolio is a wide dispersion of pairwise correlations, having a mean of approximately zero.
- In a finite portfolio with this correlation structure, there is general agreement that capital based on EPE alone is not adequate to cover all risks.
- Work by the various parties suggests that, subject to other considerations, a value for  $\alpha$ , of not more than about 120 % should suffice to cover these risks, and so be applied to EPE to generate a viable capital calculation in the absence of other effects leading to the increase of correlation between exposures or between systemic default events and exposure, e.g. wrong way risk.
- Some firms have performed alpha calculations taking into account not just default risk but also the impact of valuation changes due to credit migration, and have reported results that still fall within the conservative 120% value proposed here.

## **IV – Time horizon and maturity**

ISDA proposes to address below some of the issues raised in the paper prepared by Michael Gibson.

### Maturity

It is important to note, as emphasized in Michael Gibson's paper, that the maturity of a derivative impacts on its EPE : the longer the maturity, the larger the market risk volatility underpinning the EPE calculation.

The question of whether or not a maturity adjustment should apply on OTC derivative contracts is distinct however. Maturity theoretically impacts on the value of an OTC derivative, as the credit quality of each counterparty (discount spread) is influenced by maturity. However, research on swap contracts has shown that a change in the credit quality of one of the parties has virtually no impact on the swap rate. Market practice supports this finding: swap dealers tend to ignore credit quality when quoting swap rates. The insensitivity of swap rates to credit ratings may be attributed to the nature of the swap, which can be alternatively an asset or a liability to either counterparty. This is also true in the case of repos. In the light of the above, ISDA would caution against applying a maturity adjustment in the calculation of OTC derivative or repo counterparty risk charges.

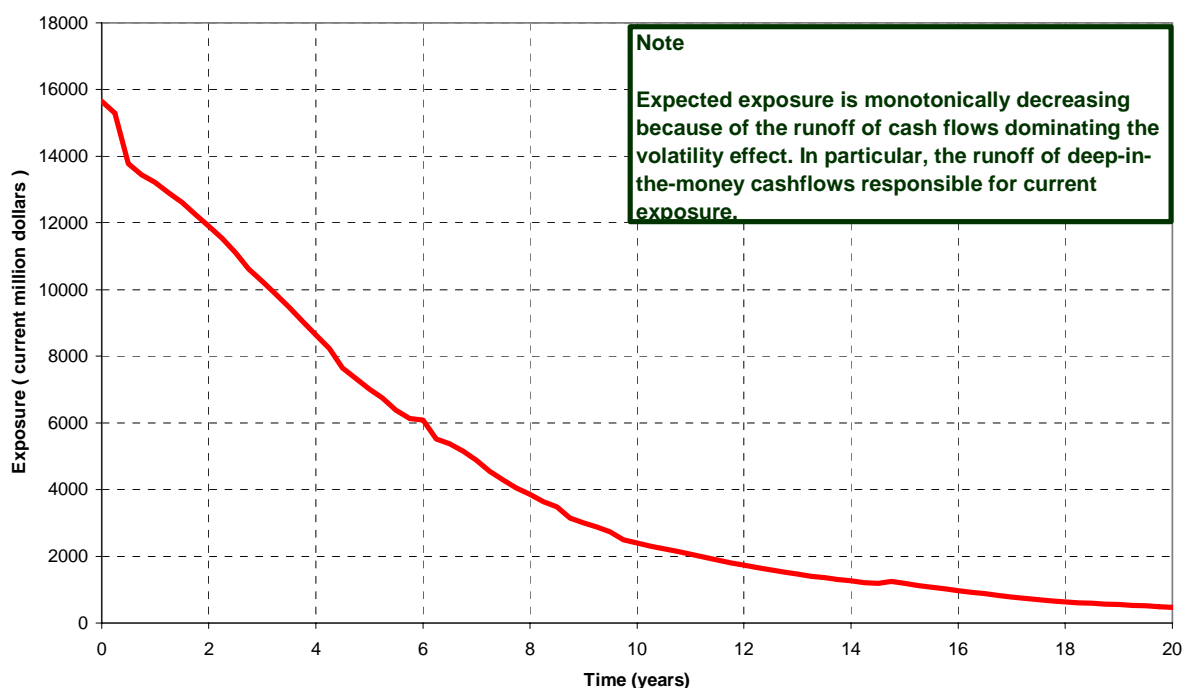
### Time horizon

The time horizon retained under the New Accord for calculating credit risk capital requirements is one year, and ISDA sees little rationale for applying a different one for OTC derivatives.

We recognise that one key difference between exposure on loans and exposure on derivatives is that the latter can increase beyond the chosen time horizon, while the former usually decreases (setting aside the case of lines of credit). We acknowledge that this might be a source of concern for the Committee and have sought to identify a solution below.

Importantly, we would strongly argue against assigning maturity adjustments by derivative type. What is relevant in the context of counterparty risk is the global shape of a firm's exposure to each of its counterparties. This tends to be fairly standardised, and concentrated at the short dated end of the spectrum.

**Typical Expected Exposure Profile of a Large Derivatives Dealer to ALL Counterparties**



As shown in the graph above, EPE one year generally stands consistently above longer measures of EPE, due to the monotonically decreasing shape assumed by the curve. In the light of this, and bearing in mind the need for implementing simple regulatory rules, ISDA would recommend using one year EPE in the counterparty risk calculation.

## **V - Treatment of collateralised OTC derivatives and securities financing transactions**

### Collateralised derivatives

1)  $EPE \times \alpha$  is a suitable measure of exposure for collateralised derivatives where the bank's internal model is fine enough to reflect the details of the collateral agreement in the EPE value. EPE should in this case be calculated using a shorter horizon than for unsecured exposures, typically 10 days for derivatives. The exposure profile under a margin agreement would be defined as the potential exposure over the margin period of risk (10 days), calculated each day over the regulatory modelling horizon of one year, and averaged. EPE will reflect changes in both the value of the OTC derivative portfolio and that of the collateral posted.

ISDA notes that in a real portfolio there will be a mixture of secured and unsecured exposures, and that in this situation, additional risk will arise if instead of netting out to zero, the positions with unsecured counterparties tend to be aligned, each tending to be offset against a margined position. This might be the case where for instance interbank exposures are margined and corporate exposures are not, or if a dealer predominantly paid fixed in interest –rate swaps with customers (unmargined) and hedged its market risk by receiving floating in offsetting swaps with other dealers (margined). In that case, the exposures to counterparties would be concentrated in scenarios where interest rates go up. A simulation of the impact on alpha values of blending margined and unmargined transactions in a portfolio was undertaken in Annex 3, which shows that alpha is mildly impacted by this source of heterogeneity, increasing from 1.09 for our base case, to 1.33 in the extreme case that all unmargined counterparties take the same directional positions (for a more precise explanation of this scenario, see Annex 3).

The firms who have calculated alpha for their own portfolios, where both collateralised and uncollateralised exposures are found, obtain values close to 1.09, i.e. the central value produced in the simulation described in part III above for unsecured exposures.

	Alpha
<i>Base case</i>	1.09
<i>Firm 1</i>	1.08
<i>Firm 2</i>	1.1
<i>Firm 3</i>	1.07
<i>Firm 4</i>	1.07

ISDA would therefore conclude that the same alpha factor can be used for both collateralised and uncollateralised portfolios of derivative exposures.

EPE for portfolios mixing collateralised and uncollateralised exposures is simply the sum of EPE collateralised and EPE uncollateralised.

2) Where the firms' EPE does not reflect every detail of the collateral agreement and as a result overestimates the impact of collateral taking, ISDA agrees, as proposed by Michael Gibson, that a reasonable means of rendering the EPE measure more conservative would simply consist in lengthening the margin period of risk. The specific risk period retained by the firm should be subject to supervisory approval.

#### Securities financing transactions

Securities financing transactions (SFTs), such as repo and securities lending transactions, are collateralised transactions, with a liquidation period broadly equal to 5 days (though often shorter, in some instances equalling one to three days). The same reasoning developed above in the case of collateralised derivatives is therefore applicable, leading to the identical conclusion that applying an alpha value of 1.09 to SFTs is reasonable.

#### **VI - Validation of EPE-based measures of future exposure**

Because of the horizon used for calculating EPE (one year for unsecured exposures), it is difficult to conceive of a methodology that could be used to backtest estimates of EPE against observed exposures. The difficulty encountered in this regard is of a nature similar to that found by regulators seeking to validate exposure at default (EAD) estimates used by banks under the Advanced Internal Ratings Based Approach. Because EADs are estimated over a long period, it is impossible to apply a formal backtest. The models used to derive them can however be validated via the use of statistical techniques (statistical tests on regression models for example). A very similar approach, relying on model validation, should be used for EPE.

One further consideration worth bearing in mind is the fact that, from a counterparty risk perspective, regulators should be focusing not on exposure generally speaking, but on exposure in default of the counterparty. It is possible for firms to compare exposure in default with EPE estimated for the defaulted exposure, but the small number of OTC derivatives or securities financing transactions defaults means that little significance will be derived from these tests. Here, a parallel can be drawn with the validation of probabilities of default (PDs) and loss given default (LGD) estimates for highly rated counterparties under IRB. No test is available for firms to validate PD and LGD estimates for AAA rated exposures.

In view of the above, ISDA would recommend relying on model validation (validating the model itself and the parameters used) and stress-testing instead of backtesting.

## ANNEX

# TABLE OF CONTENTS

<u>ANNEX 1 – ISDA-LIBA-TBMA COUNTERPARTY RISK MARKET SURVEY 2003.....</u>	<u>2</u>
<b>A- INTRODUCTION AND BACKGROUND .....</b>	<b>3</b>
<b>B- SURVEY RESPONDENTS.....</b>	<b>3</b>
<b>C- SURVEY FINDINGS .....</b>	<b>4</b>
<i>Question One .....</i>	<i>5</i>
<i>Question Two:.....</i>	<i>10</i>
Question 2.1 : Percentage of derivatives portfolio collateralised .....	10
Question 2.2 : Types of collateral used.....	11
Question 2.3 : Frequency of margining .....	12
Question 2.4 Collateral thresholds and minimum transfer amounts (MTAs)..	12
<i>Question Three.....</i>	<i>13</i>
<b>APPENDIX: COUNTERPARTY RISK MARKET PRACTICE SURVEY....</b>	<b>29</b>
<u>ANNEX 2 - New Proposal To Ascertain Credit Equivalent Amount for Counterparty Credit Risk .....</u>	<u>34</u>
<u>ANNEX 3 - CALCULATION OF ECONOMIC CAPITAL BASED ON EPE .....</u>	<u>44</u>
<u>ANNEX 4 - ANALYTIC <math>\alpha</math> CALCULATIONS.....</u>	<u>54</u>
<b>1. Summary .....</b>	<b>55</b>
<b>2. Analytic calculations for ISDA's <math>\alpha</math> simulations .....</b>	<b>55</b>
<b>3. Discussion of Michael Gibson's results .....</b>	<b>61</b>
<b>Attachment 1: Agreement between <math>\alpha</math> simulations (Annex 3) and analytic results .....</b>	<b>64</b>
<b>Attachment 2. Results in the case <math>N = \infty</math> (Michael Gibson's case). .....</b>	<b>65</b>
<b>Attachment 3: VBA code for the function <math>\alpha</math> used for Attachment 1. ....</b>	<b>66</b>
<b>Attachment 4. Calculation of the granularity adjustment coefficients <math>\beta_1</math> and <math>\beta_2</math> .....</b>	<b>67</b>

**ANNEX 1 – ISDA-LIBA-TBMA  
COUNTERPARTY RISK  
MARKET SURVEY 2003**

**ISDA-LIBA-TBMA  
COUNTERPARTY RISK MARKET SURVEY 2003**

**A- INTRODUCTION AND BACKGROUND**

ISDA initiated a dialogue with the Models Task Force on a possible review of the counterparty risk treatment of OTC derivative transactions in 2001. The Capital Accord reform seemed the perfect opportunity to undertake this review, and ISDA presented concrete proposals to this end in its commentary on CP2, published in May 2001. The Models Task Force unfortunately chose to carve out derivatives counterparty risk from the scope of the New Accord, a decision contrasting with the steps simultaneously taken by the Capital Group to amend the counterparty risk treatment of repurchase agreements and stock lending. Although the industry welcomes the recognition of portfolio VaR modelling for repo-style transactions, the Associations are concerned that the current divergence of treatment between derivatives and repos may preclude the “regulatory” netting of future exposure between these products, despite the many common economic features between them (repos can be represented as forwards). At worst, industry endeavours to achieve a higher degree of cross product netting may be frustrated at source.

We remain hopeful however, that the Models Task Force and the Capital Group will jointly review the capital treatment of repos and OTC derivatives very shortly after the publication of the New Accord, with a view to implementing any necessary changes at the same time as the Accord.

In a spirit of co-operation, ISDA, TBMA and LIBA have designed a survey aimed at providing the Models Task Force with further information on (i) the modelling of future exposure arising from OTC derivative and securities financing transactions by member firms –Question One- ; (ii) collateral management practices for OTC derivatives – Question Two- ; (iii) the reasonableness of the weak independence assumption underpinning the May 2001 ISDA proposal on counterparty risk – Question Three-.

The contents of this survey were discussed with a subset of the Models Task Force before the survey itself was published.

We are reporting below on the survey findings, with a view to providing as detailed information as possible.

For confidentiality reasons it has not been possible to append a list of respondents, but some useful information on the type of firm and principal place of business of respondents is included immediately below.

**B- SURVEY RESPONDENTS**

Fifteen firms responded to the survey including three investment firms, and twelve internationally active banks. Most of these firms are major players in the securities

financing and OTC derivatives markets. A geographical breakdown is provided in Table 1 below.

Table 1

***Breakdown by region of survey respondents***

	Europe	North America	Asia
<b>Geography [%]</b>	47%	40%	13%
<b>Geography [number]</b>	7	6	2

Most firms (14 out of 15) responded to Question One. The response rate was comparable for Question Two. However, only 40% of firms were able to produce the graphs requested in Question Three. Of the remaining 60%, most quoted technical hindrances and cost as primary motivations for not contributing.

Table 2

***Sections of the Survey Completed***

***Question One***

	Globally	Europe	North Am.	Asia
Completed	94%	47%	40%	7%

***Question Two***

	Globally	Europe	North Am.	Asia
Completed	87%	47%	33%	7%

***Question Three***

	Globally	Europe	North Am.	Asia
Completed	40%	20%	13%	7%

**C- SURVEY FINDINGS**

The survey consisted of three questions. Question One focused on the measures of future exposure used by firms to set credit limits and allocate capital internally, distinguishing between OTC derivatives and securities financing. Question Two aimed to provide a broad description of industry practices in the field of OTC derivatives collateral management. Question Three was designed to measure how well the weak independence assumption underpinning ISDA's response to CP2 was supported by firms' own exposure correlation data.

### Question One

*“Please detail the measures of counterparty credit exposure (e.g. : expected exposure, PFE, EPE) your firm uses for the specified purposes, distinguishing between collateralised and uncollateralised exposures.”*

Firms were asked to describe the measures of future exposure (FE) they use for managing counterparty risk in OTC derivatives and securities financing portfolios, as well as the methodology employed to obtain these measures. A distinction was drawn between FE measures used (i) for setting credit limits and (ii) for calculating counterparty risk economic capital. 14 out of the 15 firms included in the survey responded, showing uniformity of practice:

**1- Strong consistency exists among respondents on the approach to setting counterparty risk limits in portfolios of OTC derivatives and securities financing transactions.** The measure of exposure used in both cases is generally **peak exposure**, evaluated at a percentile comprised between 90% and 99%.

The exposure profile is measured on a full time to maturity basis for unsecured trades. The time horizon employed for collateralised positions generally reflects any applicable margining agreement. Where daily margining applies, the liquidation period retained varies between 1 and 15 days, and is shorter for securities financing (typically between 1 and 5 days) than for collateralised derivative trades (generally approximately 10 days).

**2- For allocating economic capital, industry practice increasingly converges towards an EPE based standard.** In OTC derivative portfolios, 9/15 of respondents use Expected Positive Exposure (EPE) or loan equivalent exposure for measuring FE. The latter metric is generally presented as conceptually consistent with EPE, albeit more conservative : some firms set it equal to EPE plus an upward adjustment capturing counterparty credit quality and/or concentration risk. 3/15 of respondents use peak exposure.

For securities financing transactions, only four firms filled in the questionnaire.  $\frac{3}{4}$  use adjusted EPE as a basis for calculating counterparty risk capital.

Going forward, respondents aspire to achieving a higher degree of netting. Legal agreements allowing cross product netting, such as the Cross Product Master Agreement [CPMA], promoted by TBMA and ISDA, or the ISDA Agreement Bridge, were designed to enable this further level of offsetting. Beyond the netting of current market values, firms are increasingly focusing on the netting of future exposure. This ideally requires to use a common measure of future exposure across the array of products embedded under cross product netting agreements. In the light of counterparty risk market practice, it would be sensible to base this common measure upon EPE.

**3 -Firms generally apply the same exposure modelling methodology for setting credit limits and for calculating economic capital. Monte Carlo simulation is the approach of choice for portfolios of OTC derivatives.** Where it is not, or only partially used, firms often mention their intention to move to full Monte Carlo in the near term future.

**Less elaborate modelling is employed for securities financing**, including historical simulation, variance-covariance and MTM+add-ons.

The level at which aggregation of future exposure occurs generally reflects the sophistication of modelling. Most firms using an add-on based measure do not, or only partly, net FE at counterparty level. By contrast, all firms using Monte Carlo simulation do so.

The detail of the responses is provided in the tables below.

Table 3

**OTC derivatives - Measures of future exposure used for setting counterparty risk limits**

Firm	Measure of exposure used	How is exposure profile produced	How are transactions aggregated	Time horizon
1	97.5% peak exposure	Monte Carlo simulation	At counterparty level (*)	Time to maturity
2	95% peak exposure	MTM + internal add-on	Counterparty level	Time to maturity
3	97.5% peak exposure	Monte Carlo simulation	Counterparty level	Time to maturity for uncollateralised 10 days for collateralised
4	98% peak exposure	Variance Covariance	Counterparty level	Time to maturity for uncollateralised
5	95% peak exposure Limit schedule is imposed on PFE profile. Lower limits are imposed on longer term exposures.	Monte Carlo simulation	Counterparty level	Time to maturity for uncollateralised 10 days for collateralised
6	Peak exposure	MTM + add-on Monte Carlo to be used in future	Counterparty level.	Time to maturity
7	97.5% peak exposure	Monte Carlo simulation	Counterparty level	Time to maturity
8	99% peak exposure	Analytical approximation to Monte Carlo simulation	Counterparty level	Time to maturity
9	95% peak exposure	Revaluing in three scenario, 2 extreme, one intermediate	Counterparty level Netting of trades at risk factor level	Time to maturity for uncollateralised 15 days for collateralised
10	97.7% peak exposure	Mainly Monte Carlo simulation For exposures not covered by Monte Carlo, MTM+add-on	Counterparty level No netting of add-ons for counterparties falling outside the scope of Monte Carlo simulation	Time to maturity for all transactions
11	95% peak exposure	Monte Carlo simulation for large customers, otherwise MTM + add-on For some trade, a constant future exposure is used	Counterparty level. A discount is applied to the sum of add-ons to reflect netting	Time to maturity
12	Peak exposure 90%	Monte Carlo simulation	Counterparty level	Time to maturity
13	Peak exposure 95%	Delta-gamma approximation with variance covariance Full Monte Carlo for more exotic products	Counterparty level	For unsecured, time to maturity For collateralised, liquidation period for daily margining
14	Risk equivalent exposure (EPE based)	Monte Carlo simulation [both derivative exposure and counterparty credit risk]	Counterparty level	10 day interval at each point in time in the simulation
15				

(\*) Counterparty level means that netting is applied within netting groups, according to available documentation. Positive exposures are generally summed across netting groups at counterparty level.

Table 4

**OTC derivatives - Measures of future exposure used for allocating capital internally for counterparty risk**

Firm	Measure of exposure used	How is exposure profile produced	How are transactions aggregated	Time horizon
1	Expected credit exposure	Monte Carlo simulation	At counterparty level	Time to maturity
2	Uncollateralised : MTM+add-on Collateralised : 95% peak	MTM + add-on Collateralised : variance covariance  In future : Monte Carlo	Counterparty level	Uncollateralised : time to maturity Collateralised : 10 days
3	No internal economic capital allocation			
4	98% peak exposure	Variance Covariance	Counterparty level	1 year for uncollateralised
5	Loan equivalent exposures Currently building model allowing for cross risk factor diversification	Monte Carlo simulation	Counterparty level	Time to maturity for uncollateralised 10 days for collateralised
6	Loan equivalent exposure	MTM + add-on Monte Carlo to be used in future	By transaction type	Time to maturity
7	Loan equivalent exposure	Monte Carlo simulation	Counterparty level	Time to maturity
8	Loan equivalent exposure	Analytical approximation to Monte Carlo simulation	Counterparty level	Both 1 year and time to maturity
9	Currently no economic capital calculation is performed. EPE was used in the past	Same scenarii used as for setting credit risk limits	Trades with one counterparty are partitioned by risk factor. Summation is used across risk factors	1 year for uncollateralised 15 days for collateralised
10	Peak of expected exposure profile	Mainly Monte Carlo simulation For exposures not covered by Monte Carlo, MTM+add-on	Counterparty level No netting of add-ons for counterparties falling outside the scope of Monte Carlo simulation	Peak expected exposure calculated on time to maturity basis, then used in a capital model of horizon equal to 1 year
11	EPE	Monte Carlo simulation for large customers, otherwise MTM + add-on Add-on conservatively set at 95% worst case	Counterparty level. A discount is applied to the sum of add-ons to reflect netting	1 year
12	EPE, with upward adjustment reflecting wrong way risk, counterparty rating and concentration risk	Monte Carlo simulation	Counterparty level	1 year
13	EPE, with adjustment reflecting concentration risk	Delta-gamma approximation for simple products, full Monte Carlo for exotic products.	Counterparty level	1 year (less where margining applies)
14	Risk equivalent exposure (EPE based)	Monte Carlo simulation [both derivative exposure and counterparty credit risk]	Counterparty level	10 day interval at each point in time in the simulation
15				

Table 5

**Repos - Measures of future exposure used for allocating internal economic capital**

Firm	Measure of exposure used	How is exposure profile produced	How are transactions aggregated	Time horizon
1				
2	Current value	MTM	Counterparty level	NA
		In future : Monte Carlo		
3				
4				
5				
6				
7				
8	Loan Equivalent exposure	Analytical approximation to Monte Carlo simulation	Counterparty level	Both 1 year and time to maturity
9				
10				
11				
12	EPE with adjustment	Monte Carlo simulation	Counterparty level	Min (1 year, maturity)
13	EPE, with adjustment reflecting concentration risk	Historical simulation	Counterparty level	1 year (less where margining applies)
14				
15				

Table 6

**Repos - Measures of future exposure used for setting counterparty risk limits**

Firm	Measure of exposure used	How is exposure profile produced	How are transactions aggregated	Time horizon
1	Peak exposure	Model based on maximum daily changes in risk factors	At counterparty level	1 day
2	Peak exposure	MTM + add-on ( based on actual market volatilities)	Counterparty level	3 days
3	Peak exposure 97.50%	Variance Covariance Moving to historical simulation	Counterparty level	10 days
4	98% peak exposure	Variance Covariance	Transaction level	3 days for suitably documented trades Otherwise time to maturity
5	Peak exposure	MTM+ add-on Moving to full fledged VaR models	Transaction level	Between 3 and 10 days
6	Peak exposure	MTM + add-on	Transaction level	Time to maturity
7	97.5% peak exposure	Monte Carlo simulation	Counterparty level	Time to maturity
8	99% peak exposure	Analytical approximation to Monte Carlo simulation	Counterparty level	Time to maturity
9	95% peak exposure	Revaluing transaction assuming 95th worst case move in underlying govt yield curve + spread curve	Counterparty level Individual transactions are aggregated allowing for consistency in yield/spread moves	5 days
10	97.7% peak exposure		Counterparty level	Time to maturity for all transactions
11	95% peak exposure	MTM + add-on	Counterparty level. A discount is applied to the sum of add-ons to reflect netting	Time to maturity
12	Peak exposure 97.50%	Repo : Variance covariance Others : MTM + add-on	Counterparty level	Time to maturity
13	Peak exposure 95%	Historical simulation	Counterparty level	Time to maturity, down to liquidation period if daily margining applies
14	99% peak exposure	Monte Carlo simulation [both derivative exposure and counterparty credit risk]	Counterparty level	10 day interval at each point in time in the simulation
15				

Question Two:

Question Two aimed to gather information on firms' collateral management practices in OTC derivatives portfolios.

13 out of 15 firms responded.

**Question 2.1 : Percentage of derivatives portfolio collateralised**

Respondents indicated that between a third and two thirds of their transactions had collateral attached to them <sup>1</sup>. The percentage of total exposure collateralised was fairly stable across firms, at around 33%. These results are consistent with the 2002 ISDA Margin Survey (available on [www.isda.org](http://www.isda.org), see section 4.4. on page 12). The Margin Survey further analyses collateralisation practice by type of derivative, and shows that collateral taking is more developed on fixed income and FX derivatives at large firms.

Use of collateral is constantly growing : respondents to the 2002 Margin Survey report over 28,000 collateral agreements in place, compared with 16,000 in the 2001 Survey and 11,000 in the 2000 Survey. This trend is unlikely to abate, in view of the increasing number of corporate downgrades, and the recognition of a wider range of collateral under the New Capital Accord.

Only two respondents attempted to measure the impact of collateral use on their firm's economic capital. They respectively estimated their capital savings at 6.4% and around 25%.

---

<sup>1</sup> What is measured here is the number of collateralised transactions divided by the total number of transactions.

## Question 2.2 : Types of collateral used

Responses received appear in the table below.

Table 7

Types of collateral used				
Firm No.	Cash	AAA gov't debt	Exposures to other investment grade counterparties	Exposures to non-investment grade counterparties
1	100%	0%	0%	0%
2	70%	25%	4%	1%
3	70%	30%	0%	0%
4	82.30%	15.50%	2.20%	0%
5	great majority		0%	0%
6	90%	10%	0%	0%
7	67%	21%	12%	0%
8	59%	15%	18%	8%
9	75%	17%	5%	3%
10	cash principally			
11	64%	36%	0%	0%
12	17.60%	1.00%	1.40%	0%
13	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A

US dollar and Euro cash remain the most commonly used collateral assets, followed by government securities. 6 out of 12 respondents accept investment grade corporate bonds as collateral, whilst only 3 firms accept non investment grade bonds. These results again echo the 2002 ISDA Margin Survey : among the large firms, the percentage of those accepting and delivering corporate bonds as collateral has nearly doubled from 2001, jumping from 25% to 46% (see section 3.2., page 8).

**Question 2.3 : Frequency of margining**

Margining occurs daily with the vast majority of counterparties, as evident from table 8 below.

Table 8

<b>How often is margining applied?</b>				
<b>Firm no.</b>	<b>Daily</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Other</b>
1	100%	0%	0%	0%
2	76%	14%	8%	2%
3	100%	0%	0%	0%
4	76.2%	16%	0%	7.8%
5	Majority	0%	0%	0%
6	Banks	0%	Corporates	0%
7	89.8%	3.7%	5.5%	1%
8	0%	Majority	0%	0%
9	87%	0%	13%	0%
10	N/A	N/A	N/A	N/A
11	82.2%	8.6%	7.2%	2%
12	59%	17%	17%	7%
13	89%	3%	6%	2%
14	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A

**Question 2.4 Collateral thresholds and minimum transfer amounts (MTAs)**

13 out of 15 firms commented on this question.

Practice varies substantially from one respondent to the next, reflecting diversity of internal policy. A number of salient features are however worth reporting:

- For all respondents, collateral thresholds and minimum transfer amounts are set with regard to the credit quality of the counterparty. 7 respondents explicitly link threshold amounts to the external rating attributed to the counterparty. These firms also tend to vary minimum transfer amounts by rating.
- Depending on firms, between 25% and 50% of collateral agreements include thresholds, the majority of which (between 50% and 60%) are set below EUR/US\$ 10MM. Thresholds of above EUR/US\$ 50MM represent less than 10% of the total and are typically reflective of the very high (AAA/AA rating equivalent) credit quality of the counterparty.
- A high percentage (typically between 75% and 100%) of collateral agreements include minimum transfer amounts. MTAs for high quality counterparties tend to exceed EUR/US\$ 500,000, whereas for low quality counterparties, they average EUR/US\$ 100,000.

### Question Three

*Firms were asked to graph the distribution of pair-wise correlation and covariances of exposures in their OTC derivative and repo portfolios.*

The intended purpose was to measure the degree of dependence between pairs of counterparties in firms' OTC derivatives and repo portfolios. Correlations or covariances clustering around zero for a substantial percentage of counterparties are an indicator of weak independence. For background, weak independence is the main assumption behind ISDA's original recommendation to the Basel Committee in favour of Expected Positive Exposure<sup>2</sup>. In portfolios where weak independence is not found, EPE is too lenient a measure of future exposure.

Six firms were able to produce the graphs. Only two in the sample analysed both OTC derivatives and securities financing portfolios. The others focused purely on derivatives.

The graphs confirm the existence of clustering around zero for both securities financing and OTC derivatives counterparties, at all firms but one. The exception seems, contrary to other contributors, to be an end-user of derivatives rather than a dealer. This would result in over-sensitivity to a very small number of market risk factors and the predominance of one-way exposures in their portfolio, resulting in clustering around correlations of -1 and +1.

The graphs, and where available, assumptions used by respondents, are reproduced below.

## **FIRM SEVEN**

### **Assumptions:**

Correlation between counterparty exposures is estimated using exposures simulated at the one-year point in the Monte Carlo simulation.

The exposures reflect the impact of netting and collateral.

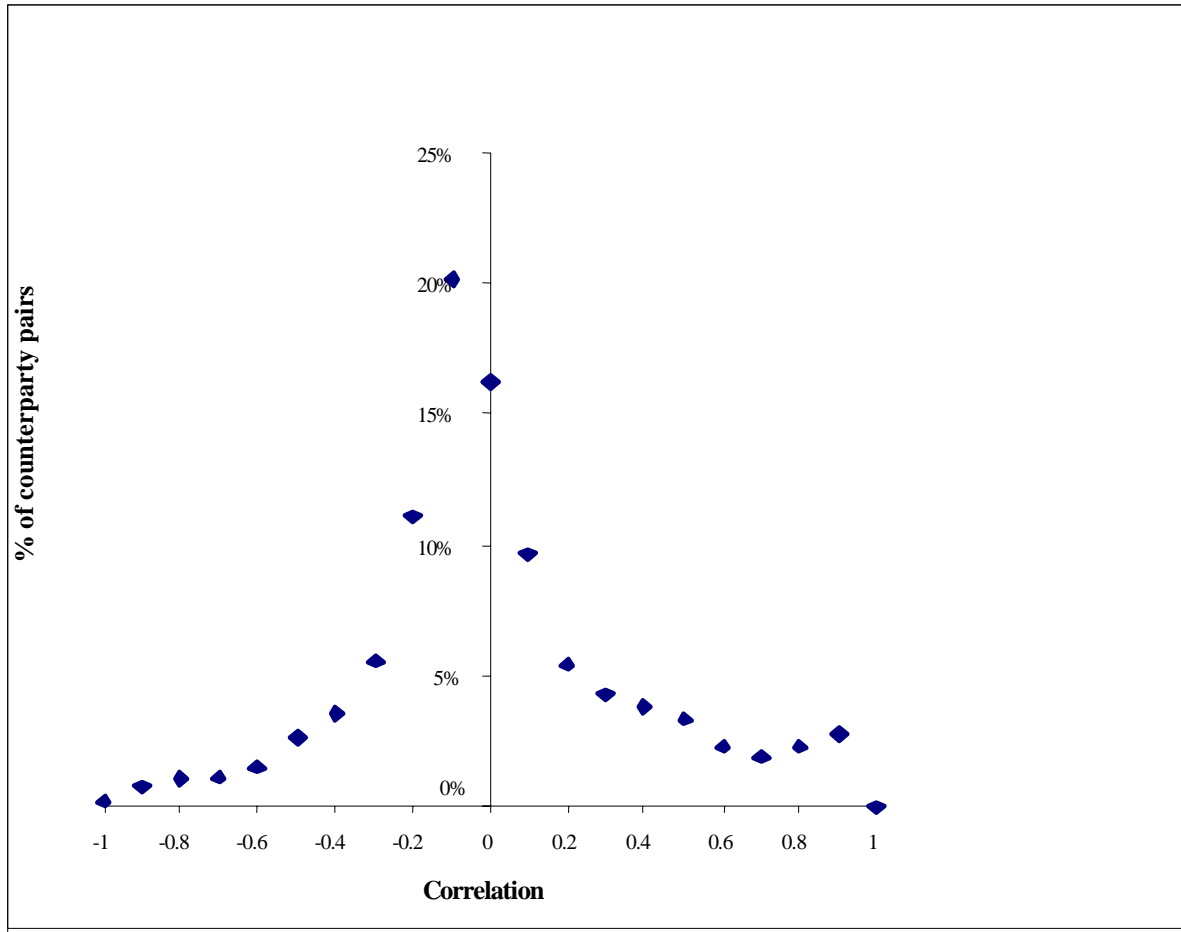
Key points:

- Correlation is estimated between counterparty exposures
- Correlation is estimated at one future point in the Monte Carlo simulation, i.e., the one-year point.
- Collateralized and uncollateralized counterparties are not separated. The impact of collateral is reflected in the exposures.

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<sup>2</sup> See ISDA's response to CP2, Annex 1, published May 2001

**FIRM SEVEN**



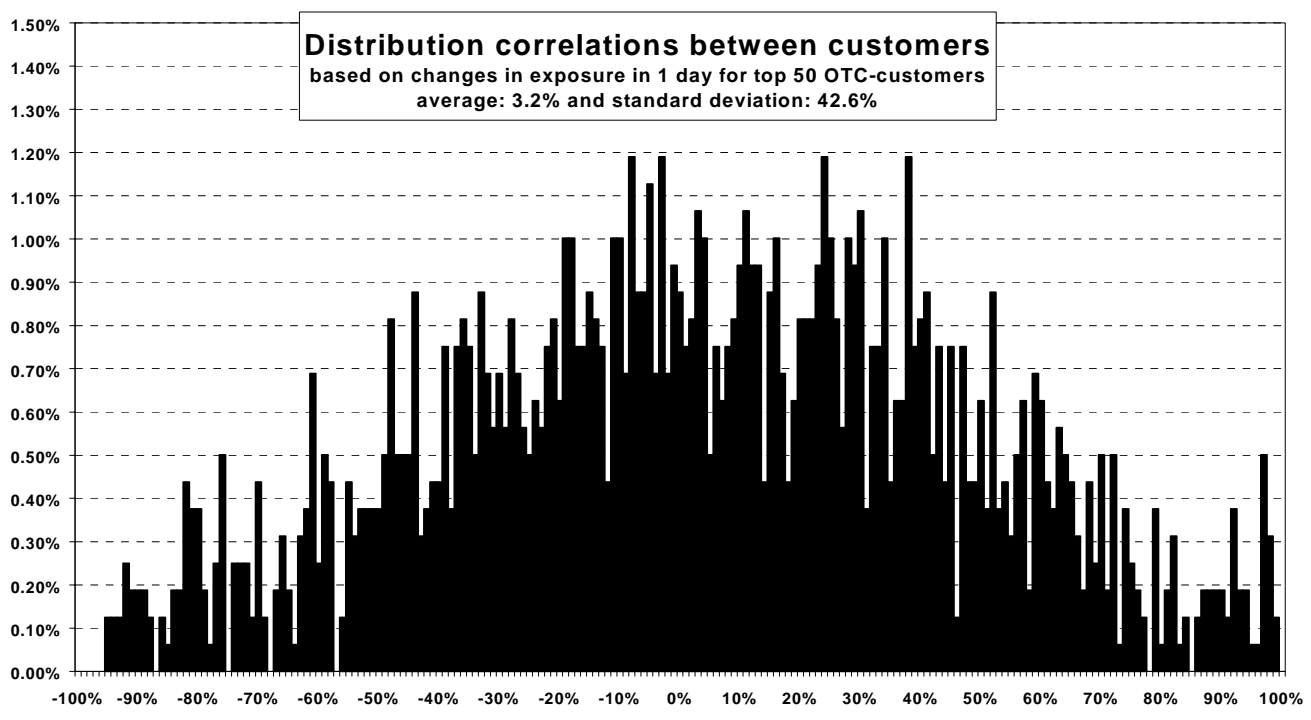
## **FIRM ELEVEN**

The analysis is based on the fixed income derivatives outstanding with the 50 largest customers. Modelling proceeds as follows:

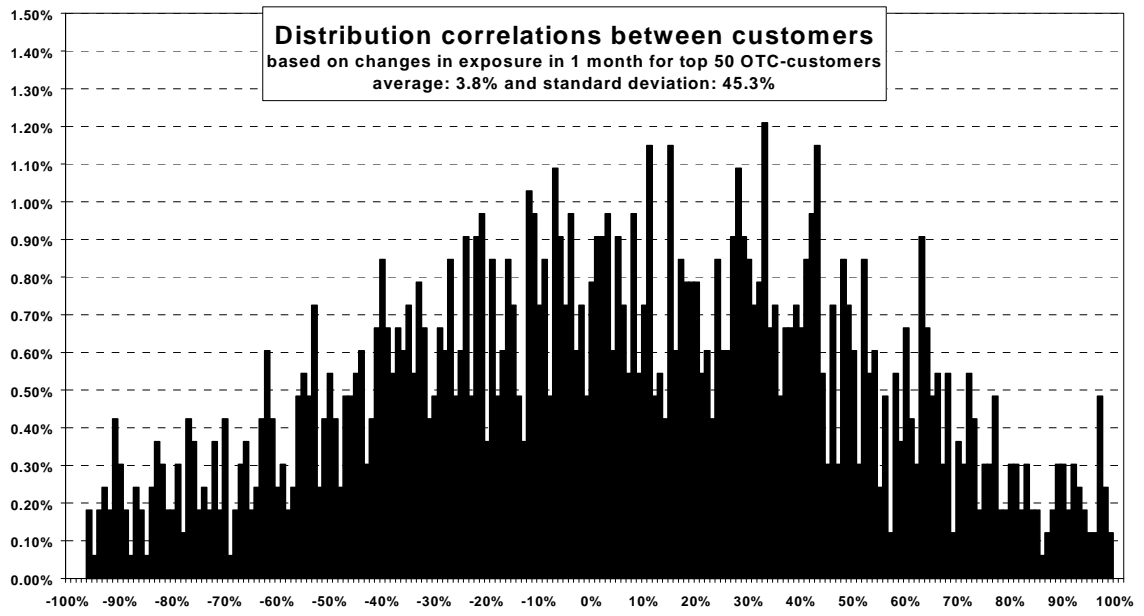
1. Generating 10,000 market rate scenarios starting today to 1 month in the future (only changes in interest and FX-rates were taken into account; volatilities and correlations were estimated using 4 years of historical data)
2. Calculating today's exposure (MTM value of portfolio) taking account of netting contracts. Collateralisation was ignored. This exposure number is fixed (non-stochastic) for each customer.
3. Calculating tomorrow's exposures and exposures in 1 month from today for each customer in each market scenario.
4. Calculating the change in exposure between today and tomorrow (as input for 1-day correlation) and the change in exposure between today and 1 month in the future (as input for 1-month correlation), for each customer and in each market scenario.
5. Calculating for each pair of customers the 1-day and the 1-month correlation based on the change in exposure over 1 day or 1 month. In this analysis, the changes in exposures for different customers are compared and based on the same market scenario.

Please find below the histograms obtained following this analysis. The difference between the histogram of 1-day and 1-month correlations is limited. The distribution of both correlations is quite close to a uniform distribution, which supports the weak independence assumption.

**FIRM ELEVEN**



**FIRM ELEVEN**



## **FIRM TWELVE**

Our internal exposure simulation engine generates exposure distributions at each of 150 future time points per counterparty. The distribution *at each of these time points* consists of 1000 values. FX and IR moves for all major currencies / currency pairs are simulated to obtain these exposures (with netting agreements and collateral taken into account).

We obtained the correlation and covariance results for the non-repo OTC portfolio study using the simulation engine mentioned above. For the repo study we used the delta approach proposed by ISDA.

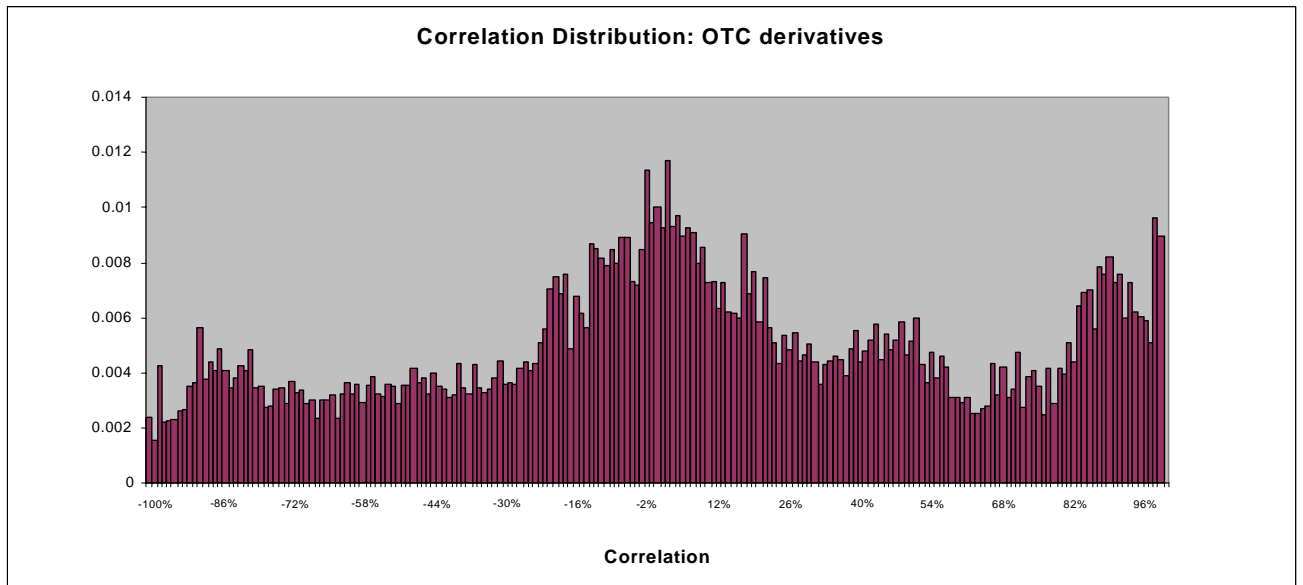
Due to the amount of processing time involved we concentrated on two hundred counterparties (representing the 'biggest risks' as measured by portfolio risk contribution) for the non-repo portfolio study. The figures and tables below summarise the results *at the one year horizon*. The data shown includes aggregated collateralised and uncollateralised OTC derivatives: we were not able to provide a finer breakdown.

The data indicates that the non-repo portfolio has an average correlation across the portfolio of 7.19%. We point out that this figure is the average across the top two hundred risk contributors (not the whole portfolio or 200 randomly selected counterparties).

The repo results provided are for the entire repo portfolio, not a subset.

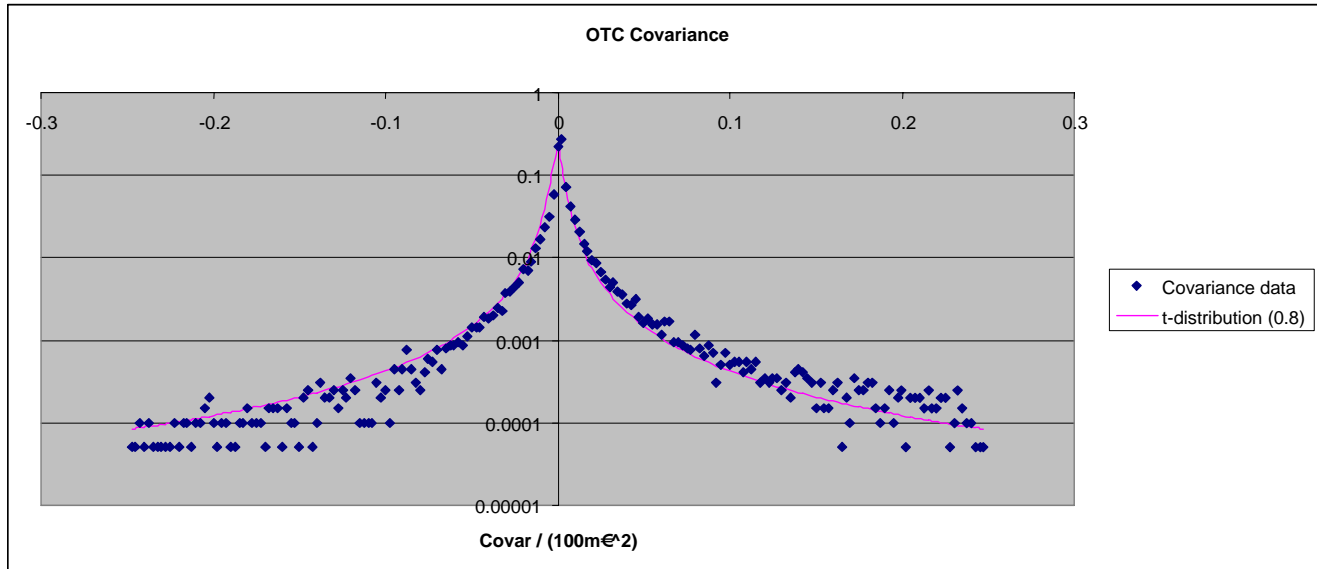
**FIRM TWELVE**

**Frequency Distribution of OTC counterparty correlations**



## FIRM TWELVE

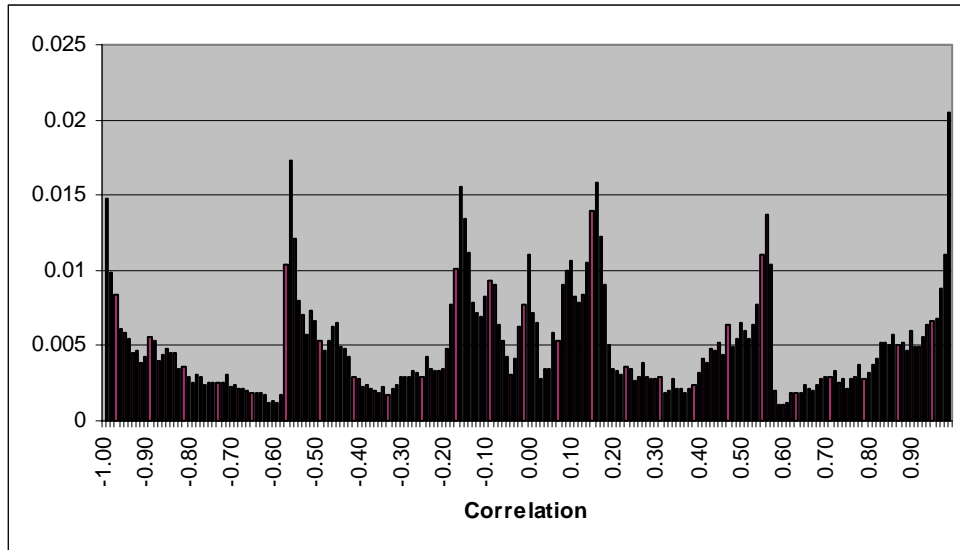
### Frequency distribution for OTC covariances



## FIRM TWELVE

### Securities Financing

#### Probability density of correlations

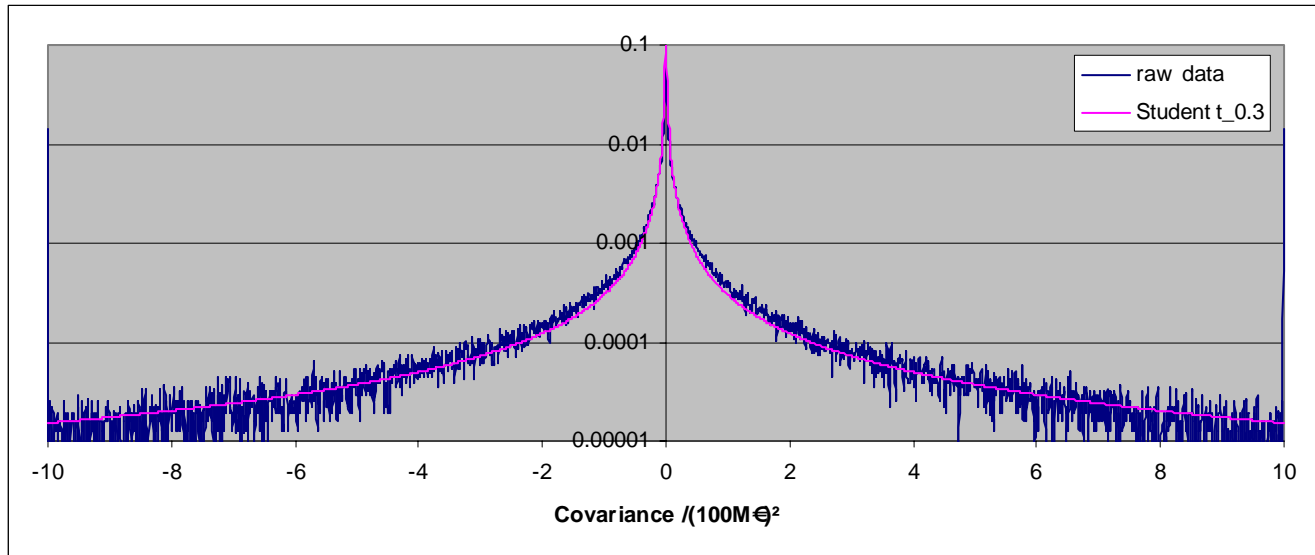


The symmetry in this graph appears to reflect the fact that risk is analysed using only the deltas.

## FIRM TWELVE

### Probability density of covariances

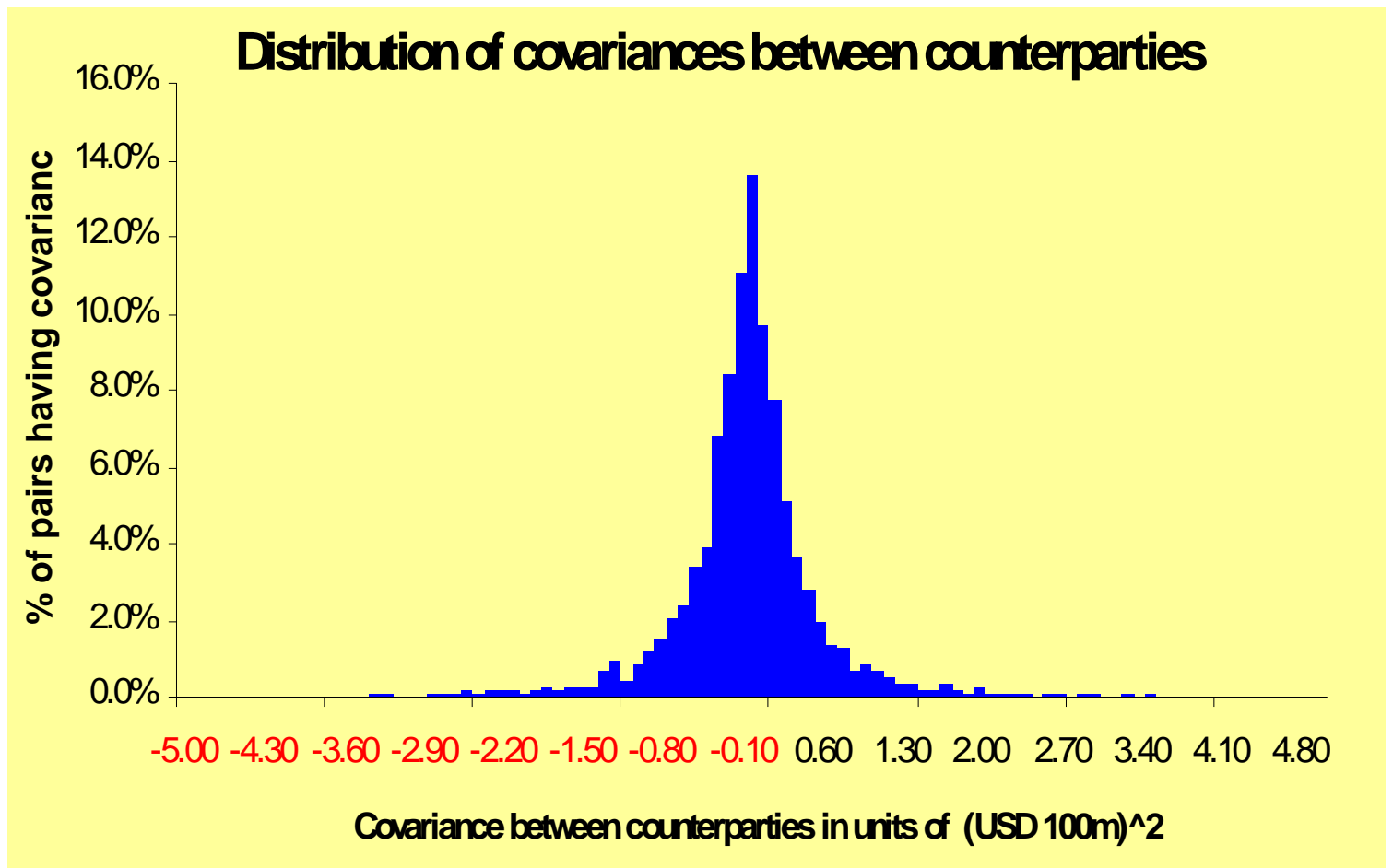
Note that the vertical scale is logarithmic.



About 2% (1% on each side) of the data points lie outside the range  $\pm 10^{17} \text{€}^2$  and hence are missing from the graph. The covariances incidentally follow very closely a Student t distribution with 0.3d.f.

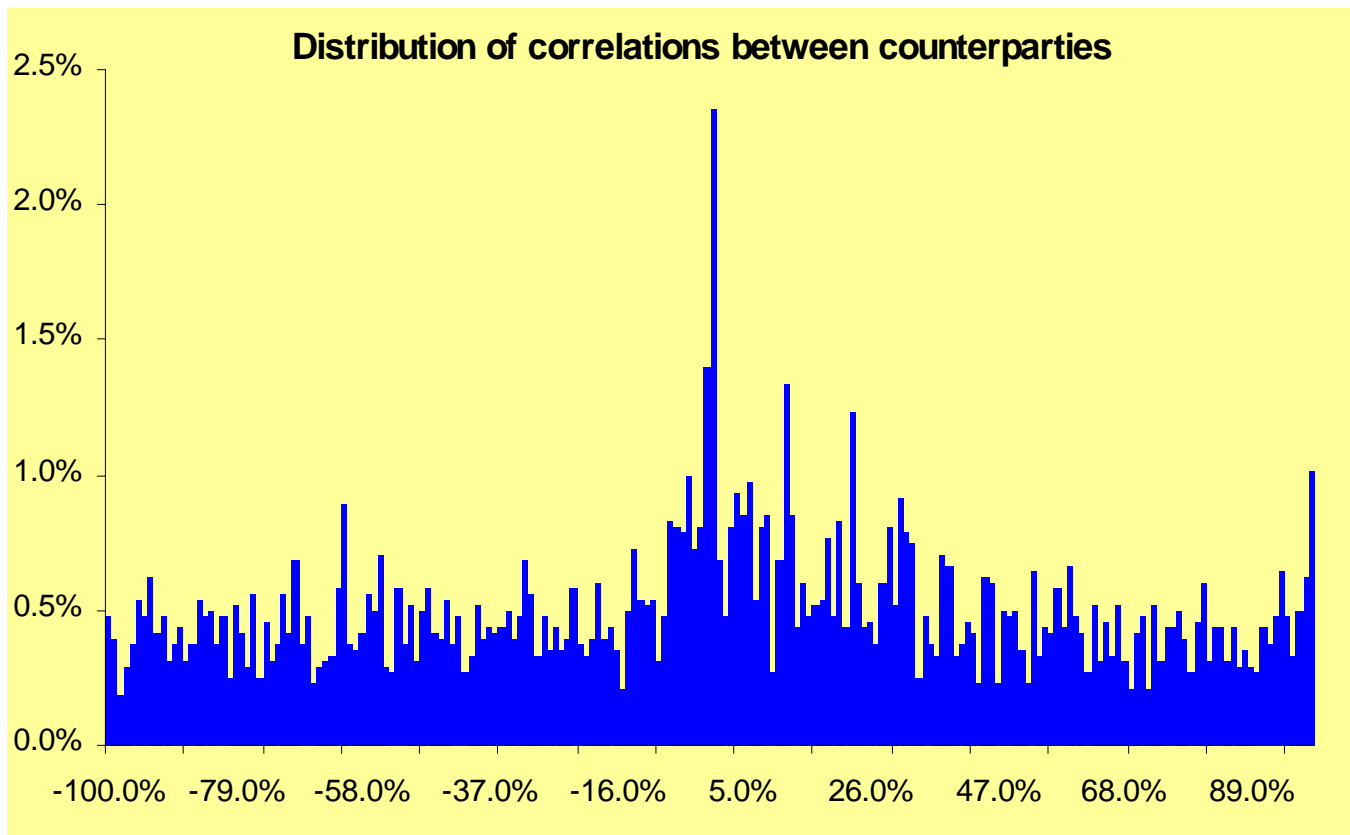
**FIRM THIRTEEN**

**Covariance chart- OTC derivatives**

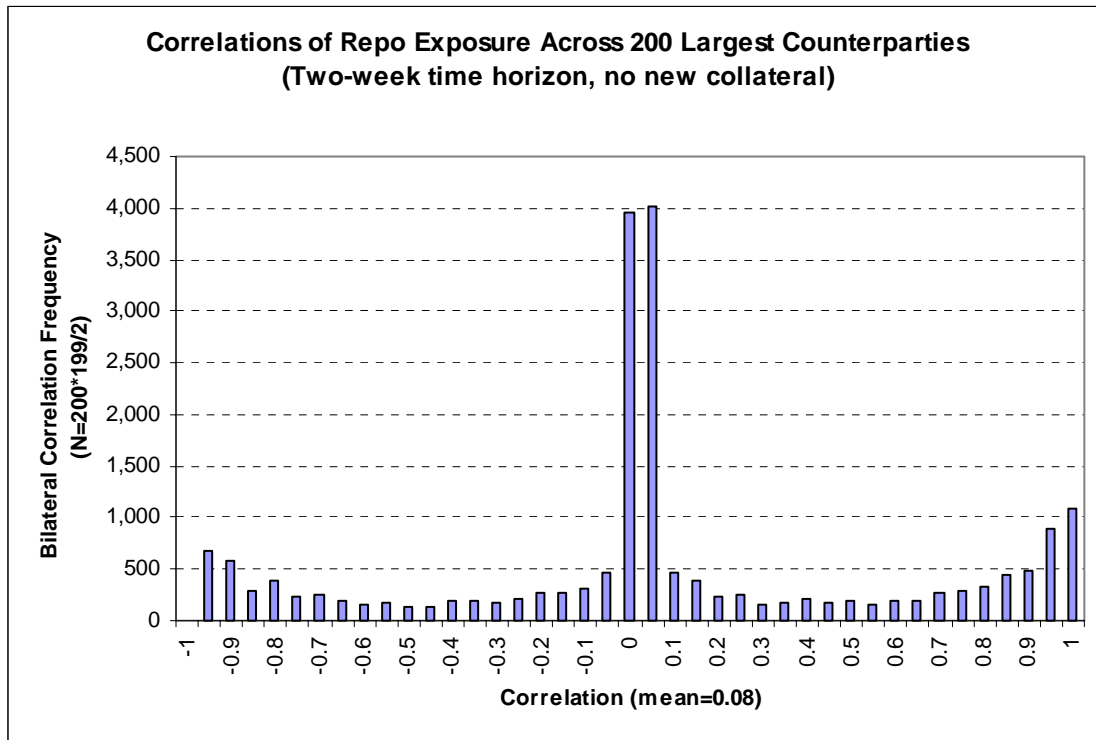


**FIRM THIRTEEN**

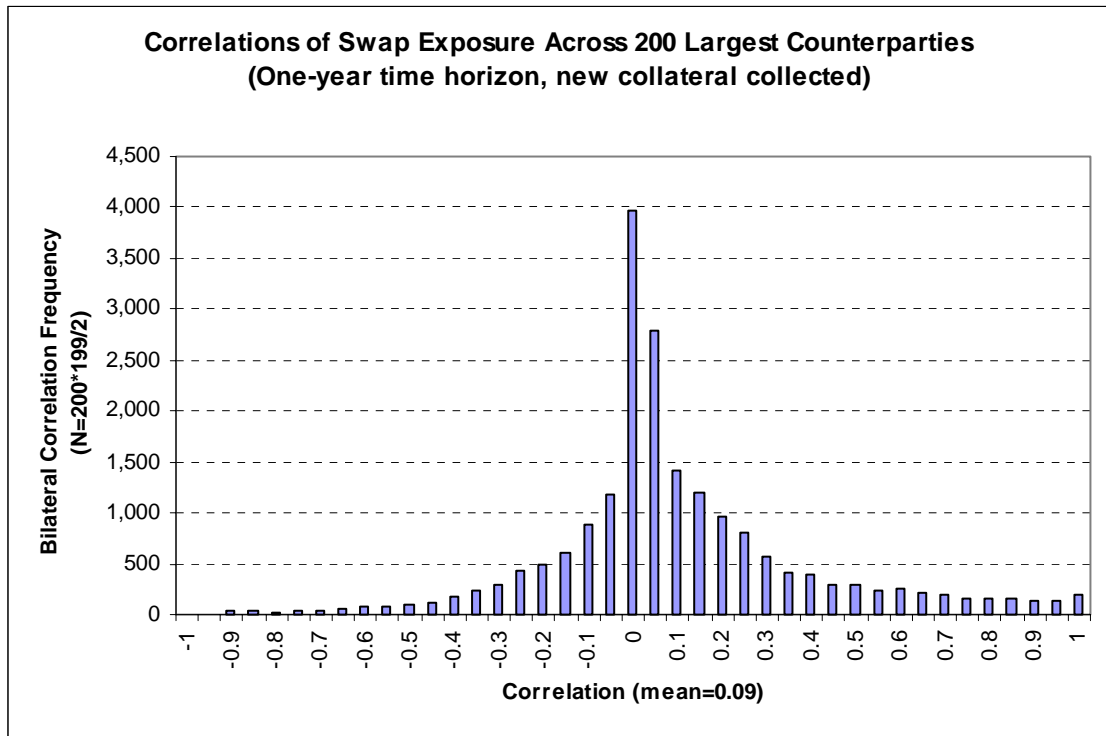
**Correlation chart – OTC derivatives**



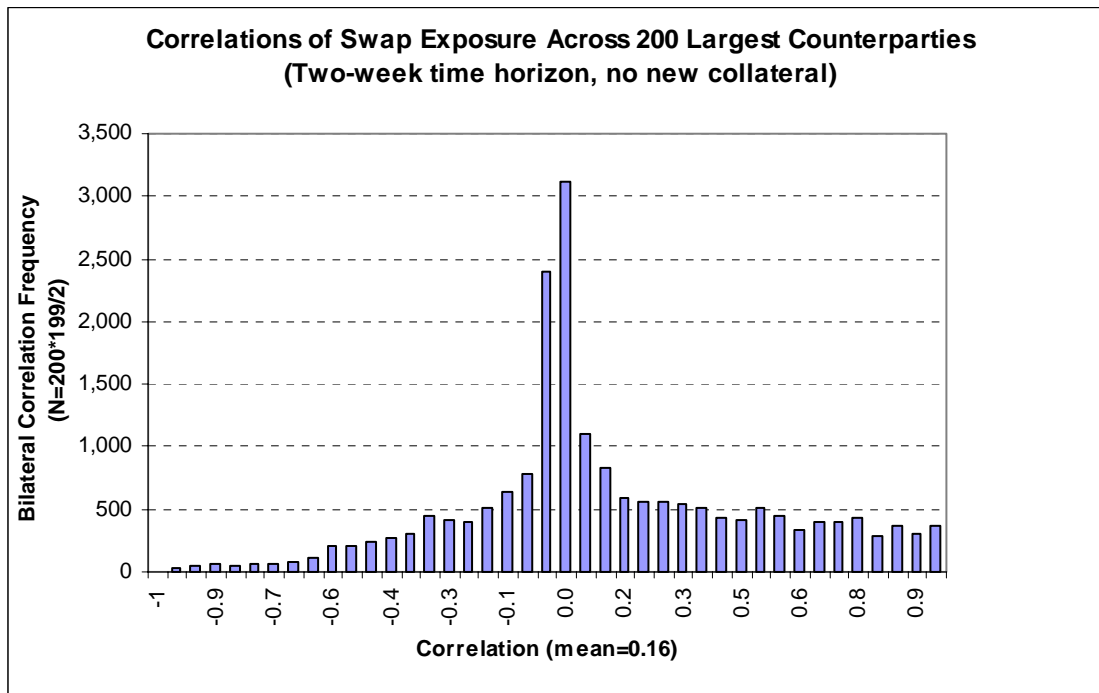
**FIRM FOURTEEN**



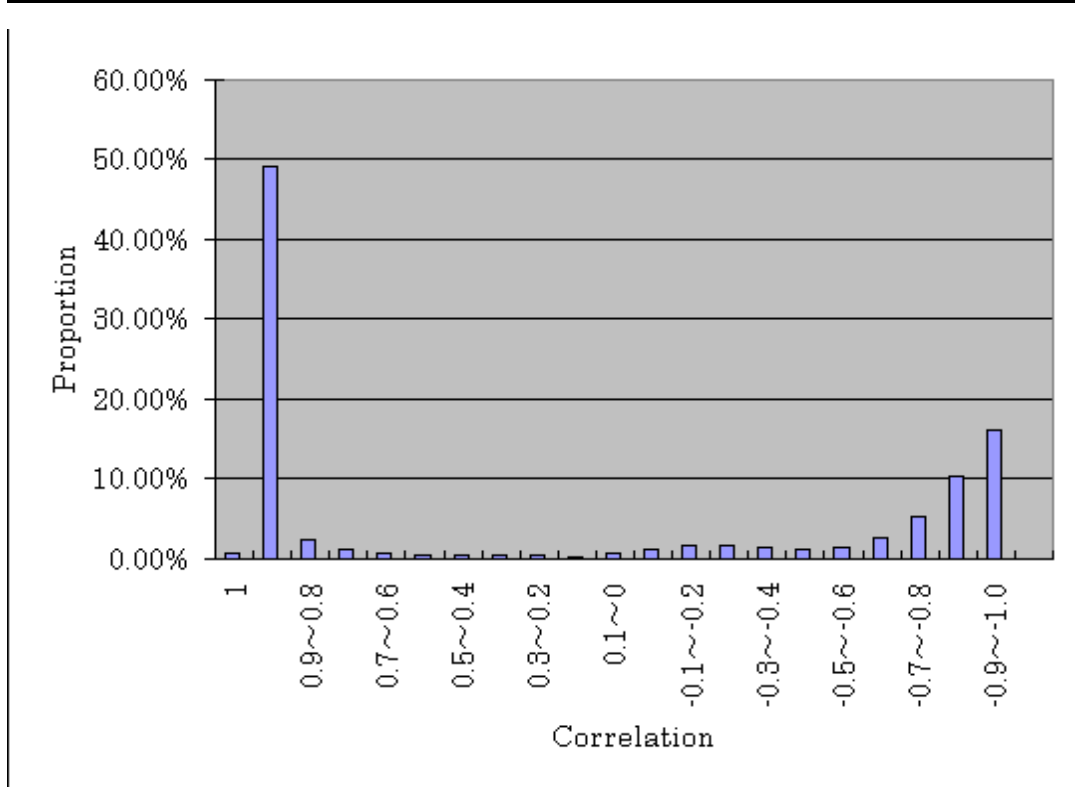
**FIRM FOURTEEN**



**FIRM FOURTEEN**



**FIRM FIFTEEN**



## APPENDIX: COUNTERPARTY RISK MARKET PRACTICE SURVEY

 International Swaps and Derivatives Association, Inc. One New Change London, EC4M 9QQ Telephone: 44 (20) 7330 3550 Facsimile: 44 (20) 7330 3555 email: <a href="mailto:isda@isda-eur.org">isda@isda-eur.org</a> website: <a href="http://www.isda.org">www.isda.org</a>	 LONDON INVESTMENT BANKING ASSOCIATION 6 Frederick's Place London, EC2R 8BT Tel: 020 7796 3606 Fax: 020 7796 4345 e-mail: <a href="mailto:liba@liba.org.uk">liba@liba.org.uk</a> website: <a href="http://www.liba.org.uk">www.liba.org.uk</a>	 THE BOND MARKET ASSOCIATION 40 Broad Street New York, NY 10004-2373 Tel.: 212.440.9400 Fax: 212.440.5260 website: <a href="http://www.bondmarkets.com">www.bondmarkets.com</a>
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25 February 2002

Counterparty risk market survey

Dear All,

The Models Task Force has informed ISDA that, in view of the Basel Committee's revised timetable, they will not include a review of counterparty risk for OTC derivatives in CP3. They are willing, however, to revisit the subject as soon as the New Capital Accord has been finalised; this is likely to happen in late 2003. Provided we act in a timely manner, changes in the capital treatment of counterparty risk that are developed after publication of the Accord could be implemented at the same time as the Accord itself.

With regard to the content of the survey itself, the MTF has requested a more targeted and detailed view of the proposed measures of counterparty risk than we originally suggested. We have consequently revised the survey and designed the questions to provide information regarding the following regulatory concerns:

*Expected exposure* - The MTF has objected to the adoption of expected exposure on the grounds that it is not a commonly used measure. ISDA has responded that firms use different measures for different purposes, that expected exposure is the appropriate measure for economic capital allocation, and that some firms have adopted more sophisticated measures that are consistent with expected exposure.

*Secured financings* - ISDA has argued that issues applying to OTC derivatives also apply to secured financing and that the approach taken to measuring future exposure should be consistent for both.

*Margin practices* - The MTF has requested information regarding the convergence of derivatives collateral management practices with securities financing management practices.

*Weak independence* - The MTF has questioned the reasonableness of the weak independence assumption, which underpins use of expected positive exposure.

Attached is the final version of the survey form. **Please send your completed survey form to Emmanuelle Sebton (esebton@isda-eur.org) by 31 May 2002.** Should you require additional information, please do not hesitate to contact Emmanuelle in London, or David Mengle in New York ([dmengle@isda.org](mailto:dmengle@isda.org)).

Yours sincerely,

Emmanuelle Sebton  
ISDA  
Head of Risk Management

David Mengle  
ISDA  
Head of Research

Katharine Seal  
LIBA  
Director

Omer Oztan  
The Bond Market Association  
Vice President and Assistant General Counsel

## **Counterparty Risk Market Survey**

*ISDA, LIBA and TBMA members are kindly requested to provide the following information regarding their counterparty risk management practices by 31 May 2002.*

### Question 1: Measures of counterparty credit exposure

Please detail the measures of counterparty credit exposure (e.g., expected exposure, PFE, EPE) your firm uses for the specified purposes. Please distinguish between treatment of collateralized and uncollateralized exposures.

#### A. OTC derivatives

##### 1. Setting counterparty risk limits

a. What measure do you use?

b. How do you approximate the exposure profile?

c. How do you aggregate exposures (by transaction or on portfolio basis)?

d. What time horizon do you use for estimation of the exposure profile?

##### 2. Economic capital calculation

a. What measure do you use?

b. How do you approximate the exposure profile?

c. How do you aggregate exposures (by transaction or on portfolio basis)?

d. What time horizon do you use for estimation of the exposure profile?

Other uses: Please detail in Remarks section on following page.

#### B. Securities financing (includes both repurchase agreements and securities lending)

a. What measure do you use?

b. How do you approximate the exposure profile?

c. How do you aggregate exposures (by transaction or on portfolio basis)?

d. What time horizon do you use for estimation of the exposure profile?

**Question 1 (continued): Measures of counterparty credit exposure**

**Remarks:** (Please specify additional detail, including other uses of counterparty exposure measures used, which might be useful to supplement the above information.)

**Question 2: Collateralisation practice.**

Please specify:

1. What percentage of your OTC derivatives portfolio is collateralised
2. Types of collateral used

<b>Collateral type</b>	<b>Percent of exposures covered</b>
Cash	
AAA government debt	
Exposures to other investment grade counterparties	
Exposures to non-investment grade counterparties	

3. How often margining is applied (daily, weekly, monthly, other)
4. What collateral thresholds or minimum transfer amounts apply? Please specify if they vary by rating.

### Question 3: Weak independence.

Please graph separately the distribution of correlations and covariances in the following portfolios: (a) collateralised (marginised) OTC derivatives; (b) uncollateralised OTC derivatives; and (c) repurchase agreements. The resulting graphs should show:

- (i) Proportion of counterparty pairs having given correlation (in appropriate bands, e.g. bands of 1% from -100% to + 100%); and
- (ii) Proportion of counterparty pairs having given covariance (in appropriate bands as for correlation).

**We encourage firms to use the modelling approaches and parameterisation they believe appropriate for producing the graphs mentioned above. Please include a brief description of the key assumptions used.**

If it is not feasible to use an internal model, we suggest responding firms use the following alternative methodology:

1. For each counterparty, compute the FX and IR deltas in each major currency (as a guide, an internationally active bank will typically need at least 10 currencies and therefore used 20 risk drivers to capture material risks, but it may not be necessary to include "minor" drivers such as equity and commodity risk). **Spot deltas may be used, but we encourage firms to use average risk over one year if possible.**
2. Compute the risks in appropriate units, namely FX deltas in US\$ and IR deltas in US\$ per basis point. Compute the covariance between each pair of counterparties A and B using the standard formula:

$$\text{Cov}(A, B) = \text{sum over risk types R and S of } [\text{delta of A in R}] * [\text{delta of B in S}] * \text{Cov}(R, S).$$

It is important to ensure covariances  $\text{Cov}(R, S)$  between market factors are expressed in the correct units, consistent with the units used for the FX and IR deltas. Covariances should cover a one year horizon.

3. Compute the correlation between A and B as:

$$\text{Corr}(A, B) = \text{Cov}(A, B) / [\text{SD}(A) * \text{SD}(B)]$$

where  $\text{SD}(R)$  = the annualised standard deviation (annual volatility) for market factor R, and so on.

4. Graph the covariances and correlations as described above.

**ANNEX 2 - New Proposal To  
Ascertain Credit Equivalent  
Amount for Counterparty Credit  
Risk**

ANNEX 2
---------

**MEMORANDUM TO:** Emmanuelle Sebtou, ISDA  
**FROM:** Evan Picoult  
**RE:** New Proposal To Ascertain Credit Equivalent Amount  
for Counterparty Credit Risk.  
**DATE:** Originally Written, September 23, 2002  
Edited with minor changes, March 24, 2003

### **SUMMARY OF MOTIVATION FOR PROPOSAL**

In 2001 ISDA proposed that the Credit Equivalent Amount (CEA) of counterparty exposure should be defined as the average of the counterparty's expected exposure over a one-year horizon.

ISDA's argument in support of this proposal was made in the context of some broad assumptions about the characteristics of a bank's total counterparty credit exposure and risk.

The proposal I am putting forward has as its main objective the measurement of the effects of different characteristics of a bank's total portfolio of counterparty exposure on the loan equivalent economic capital – i.e. on the CEA for counterparty exposure.

The type of characteristics that I propose varying are:

- The effect of the number of obligors
- The effect of the number of independent market factors
- The effect of the relative symmetry or asymmetry in exposures to a given market factor.
- The effect of margin and, more importantly, in having asymmetries in the exposures that are margined (as described below).
- The effect of the risk rating of the counterparty on the CEA.

Here are some reasons for investigating the effect of these characteristics on the CEA:

1. Not all counterparties have margin agreements. Many large corporate customers do not enter into margin agreements. In addition, in many countries around the world there does not exist an appropriate legal basis for a bank to have a sufficient degree of certainty about the legal enforceability of either netting or margin agreements in the event of default.
2. Many corporate customers have issued fixed rate debt and then swapped into floating rate exposure – i.e. they transact an interest rate swap to pay floating and receive fixed. A bank will tend to hedge this market risk by transacting offsetting interest rate swaps in the inter-bank market.
3. When 1) and 2) are combined we see that although the net market risk of a large swap portfolio may be very small, the counterparty exposure profiles generated by these swaps tend to be asymmetric in the following way - in this example, corporate obligors tend to be net receivers of the fixed rate without any margin agreements and interbank obligors tend to be net receivers of floating rates with margin agreements. This is one reason no conclusions about exposure over time can be inferred from an analysis of factor sensitivities at  $t=0$ .

4. Although the total counterparty exposure may depend on thousands or tens of thousands of market factors, changes in the total exposure to many large obligors tends to be dominated by a relatively few market factors (e.g. LIBOR yield curves of several major currencies; spot FX rates of a few major currency pairs such as US\$/Euro, US\$/Pound and US\$/Yen; several major equity indices). A consequence of this is that even if counterparty risk could be characterized as being generated by many counterparties, each with a small exposure (which is not the actual situation), the exposure to most counterparties is dominated by a relatively small number of market factors. Consequently even if counterparty defaults were for the most part independent, large changes in the exposure across counterparties tend to be correlated.
5. Margin agreements are themselves not uniform. Some derivative margin agreements have zero threshold. Other agreements have material thresholds, or thresholds that vary with the counterparties risk rating. Some margin agreements require daily margining, others have varying margin intervals (e.g. weekly or longer).

One needs to identify the consequence of these factors on the CEA of real portfolios.

#### **ESSENCE OF NEW PROPOSAL**

The essence of this proposal is to create test portfolios with different characteristics in order to systematically measure the effect of these characteristics on  $\alpha$ .  $\alpha$  is the ratio of the Economic Capital calculated with full simulation to the Economic Capital calculated using the Expected Positive Exposure Profile (EPP) of each obligor. For a full explanation of these concepts see the Appendix, particularly the section entitled “LOAN EQUIVALENT PROFILES AND SCALE FACTOR  $\alpha$ ”.

**$\alpha$  is the scale factor needed to transform the expected positive exposure profile of a counterparty into an accurate measure of the loan equivalent of economic capital – i.e. to transform the expected positive exposure profile into a CEA for Basel 2.**

**$\alpha$  can be defined broadly, for all obligors, or more narrowly, as a function of characteristics of each obligor (such as risk rating or whatever) or other features of the obligor’s portfolio.**

As explained in the Appendix, the difference between Economic Capital calculated with full simulation versus Economic Capital calculated using the Expected Positive Exposure Profile of each counterparty is as follows:

- Full simulation means simulating the potential loss distribution of the portfolio of counterparties by coherently simulating the potential exposure of each counterparty over time as a consequence of the path market factors.
  - The sequence of steps in full simulation is: first generate a path of market factors; then measure the corresponding exposure profile of each counterparty for that path; then simulate thousands of scenarios of defaults and recoveries, for the exposure profiles of all counterparties, for that path. Finally repeat the sequence by looping over thousands of simulated paths of market factors. For more details, see the Appendix.
- Simulation with fixed exposure profiles means simulating the potential loss distribution by assuming that the potential exposure of each counterparty can be represented by a fixed exposure profile, specific to that counterparty, that is independent of any particular path market factors might takes over time. For example, the fixed exposure profile of a counterparty could be defined to be proportional to its Expected Positive Exposure Profile.
  - The sequence of steps in fixed exposure profile simulation is: Simulate the potential loss distribution by simulating thousands of potential scenarios of default and recovery, using only the fixed exposure profiles of each counterparty.

At first glance, the primary difference between full simulation and simulation with fixed exposure profiles is that the former entails looping over thousands of potential paths of market factors over time. Whereas the latter does not directly require the simulation of any path of market rates – the exposure at each future date is defined by the fixed profile per counterparty.

If the fixed exposure profile of each counterparty is defined to be proportional to the counterparty's Expected Positive Exposure Profile, we can specify an additional important difference between the two methods for simulating economic capital.

First note that when one calculates Economic Capital using each counterparty's Expected Positive Exposure Profile, the sequence of steps is: The Expected Positive Exposure Profile of each counterparty is first calculated by looping over thousands of potential paths of market factors. This simulation over potential market paths is done for each counterparty independently. One then simulates the effect of default and recovery for the portfolio of counterparties, by representing the exposure of each counterparty by the counterparty's Expected Positive Exposure Profile.

The difference between the two methods of simulation of Economic Capital is:

- Full simulation entails the coherent simulation of changes in market factors and captures the volatility of each counterparty's exposure and the correlation of exposure across counterparties. To emphasize this point, full simulation captures
  1. The volatility of the potential exposure of each counterparty and the effect of this volatility on Economic Capital. All else held constant; a variable exposure increases the amount of Economic Capital relative to a fixed exposure.

2. The correlation of the potential exposure of each counterparty corresponding to each potential path of market factors. The fact that some counterparties have offsetting exposure profiles to a particular path of market factors (e.g. one counterparty is net paying fixed while another counterparty is net receiving fixed) tends to reduce the Economic Capital, all else held constant.
- Simulation by means of the Expected Positive Exposure Profiles ignores the potential volatility of each counterparty's exposure and the correlations of exposures between counterparties because each counterparty's exposure profile is independently and separately calculated by the simulation of paths of market factors over time.

**If the effect of the volatility of potential exposure and the effects of the correlation of potential exposure were exactly offsetting, for all tenors, then it should be obvious that the economic capital calculated with full simulation would be identical to the economic capital calculated using each counterparty's expected positive exposure profile – i.e.  $\alpha$  would equal 1.0**

The effect of varying the characteristics of the portfolio of obligors on the value of  $\alpha$  needs to be measured.

The characteristics that need to be varied include:

- N, the number of obligors. As N increases does  $\alpha$  asymptotically approach a constant and, if so, which constant?
- M, the number of independent market factors. All else held constant, is  $\alpha$  dependent on the number of independent market factors? In what way? What is the implication if changes in most exposure profiles are dominated by a relatively few market factors?

### **CEAS FOR THE COUNTERPARTY CREDIT EXPOSURE OF FX AND DERIVATIVES; REPO AND REVERSE REPOS; AND SECURITY BORROWING AND LENDING.**

Repos and Reverse Repos are almost always transacted with daily margin and zero threshold. The same is true for stock borrowing and lending. As a consequence the exposure profiles of these forms of security finance are identical to that of the equivalent derivative transactions with daily bilateral margin agreements and zero threshold.

As a consequence, the CEA for security finance transactions should be treated the same way as the counterparty credit exposure of FX and derivatives.

Note one **very important difference** from the VAR-type calculation proposed in Basel 2:

- The Basel proposed VAR-type calculation is for a static portfolio over a very short window (e.g. five or ten days).
- In contrast an exposure profile, even for transactions with daily margin, needs to be calculated over the lifetime of the portfolio or the appropriate CEA time horizon (e.g. one year or three years), whichever is shorter.

To illustrate this point, consider an extreme example. Assume a counterparty had entered into only one derivative transaction, a ten year interest rate swap with daily margin and zero threshold. The daily margin agreement would materially reduce the magnitude of the potential exposure. The potential exposure would equal the amount the swap could increase in value over a five or ten day margin period of risk, for each such forward period over the remaining life of the swap. This is because there potentially could be some exposure over the full ten years of the swap. A calculation of the life time credit risk of the swap would need to take into account the default probability over the full ten years as well as the potential exposure over that period of time.

**Consequently under this proposal, in order to have a consistent method for the calculation of the CEA for FX and derivative counterparty risk, repos and reverse repos and security borrowing and lending, an exposure profile would need to be calculated for all these transactions over the life of the credit exposure or the appropriate time horizon, whichever was shorter.**

## APPENDIX - DEFINITIONS OF KEY CONCEPTS AND TERMS

### SIMULATION OF COUNTERPARTY EXPOSURE PROFILE

The steps in calculating a **counterparty's exposure profile** are:

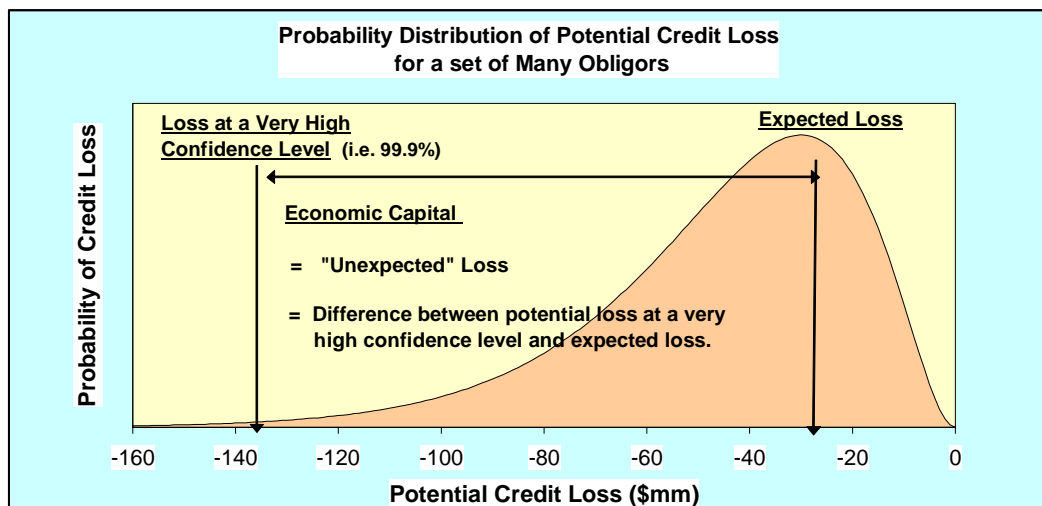
1. Simulate many **paths of the state of market factors** into the future, extending out many years over the full life of the transactions in the counterparty's portfolio.
2. Measure the **simulated market value of each transaction** of the counterparty at many future dates along each path, by means of full revaluation of each transaction, given the transaction's terms and conditions and the simulated state of the market.
3. Calculate the **simulated exposure of the counterparty** at a set of future dates along each simulated path, by aggregating the simulated future market value of each transaction of the counterparty, at a future date, in the context of legally enforceable risk mitigant agreements (e.g. netting, margin, option to early termination).
4. Calculate the **potential exposure to the counterparty at some specified confidence level**, given the distribution of simulated exposures at each future time.

A counterparty's exposure profile is a statistical picture of a firm's potential exposure to the counterparty over time; i.e. over the lifetime of the remaining transactions with the counterparty. It can be defined at any confidence level. For example, one can calculate:

- The **exposure profile of the counterparty at a high confidence level** (e.g. 99% CL).
- The **expected positive exposure profile - EPP(t)**, whose value at time t is defined as the expected value of all positive exposures (the obligor owes our firm), with negative exposures (our firm owes the obligor) set to zero.
- The negative exposure profile at any specified confidence level (useful for measuring liquidity risk).

### FULL SIMULATION OF ECONOMIC CAPITAL FOR COUNTERPARTY RISK

The calculation of economic capital for the counterparty risk of a portfolio of many obligors will be based on the potential loss distribution, as below.



The potential loss distribution critically depends on:

- **The definition of potential loss:**
  - Loss only due to potential default and potential recovery.
  - Loss due to potential fall of economic value: This includes not only the loss due to potential default and recovery, but also the loss due to an increase in the market value adjustment (a.k.a. “credit value adjustment” at some firms) for counterparty credit risk. The market value adjustment is the adjustment to the risk free valuation that takes into account each counterparty’s risk rating and general market spreads.
- The **time horizon** over which the loss is calculated (e.g. one year, three years, lifetime).

### **Steps For Full Simulation Of Potential Loss Distribution Due To Default:**

1. Simulate many **paths of the state of market factors** into the future. Each path specifies the value of all the market rates (needed to value all contracts in the portfolio) at a set of future dates
2. For **each simulated path** calculate the **simulated exposure of each counterparty** at a set of future dates:
  - a. Measure the **simulated market value** of each transaction at many future dates along the path, as above.
  - b. Calculate the **simulated exposure of each counterparty** at many future dates along the path, by aggregating the potential market value of each transaction in accordance with all legally enforceable risk mitigant agreements (e.g. netting, margin, option to early termination), as above<sup>3</sup>.
3. For **each simulated path**, calculate the **potential loss** for all of the counterparties in the portfolio. In other words, for each simulated path, at a set of forward intervals, simulate thousands of scenarios of obligor default and recovery. Each scenarios will differ by how many and by which obligors default in any future interval and by the simulated recovery, given default.
4. From the **set of simulated paths**, calculate an overall potential loss distribution. **Economic capital** is the difference between the potential loss at a high confidence level and the expected loss.

If we knew the future state of the market with certainty we would only need one path to describe the future state of the market. The simulated exposure profile of each counterparty (step 2) would be the loan equivalent for that path and we would stop our calculation with step 4 without the need to loop over many simulated paths of the market. In reality we do not know the future state of the market so we must loop over steps 1 to 3 for thousands of simulated paths. All things being equal, having variable rather than fixed exposures increases the width of the loss distribution and increases the amount of economic capital needed.

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<sup>3</sup> Note: Step 2 is equivalent to calculating a path specific loan equivalent exposure of each counterparty. That is, for a given path, each counterparty will have a specific exposure at each future date. More generally, for a specific path the credit exposure (positive or negative at any future date) can be replicated by a portfolio of spot and forward loans from and to the counterparty (i.e. loans from when our firm owes the cntprty, loans to when cntprty owes us).

## MEASURING SCALE FACTOR $\alpha$ AND DEFINING THE LOAN EQUIVALENT EXPOSURE FOR ECONOMIC CAPITAL

Let us define two measures of the economic capital of a portfolio P:

$EC(\mathbf{P}; CL, T)_{Full\_Sim\_Default}$  = Economic Capital calculated by Full Simulation, default only

$EC(\mathbf{P}; CL, T)_{Fixed\_EPP\_Sim\_Default}$  = Economic Capital calculated by assuming the exposure profile of each counterparty can be represented by a fixed exposure profile equal to its Expected Positive Profile.

$\mathbf{P}$  = The portfolio P, composed of N counterparties, each with many transactions.

CL = Confidence level at which EC is measured.

T = Time horizon over which EC is measured.

Therefore, the scaling factor,  $\alpha$ , is defined as<sup>4</sup>:

$$\alpha(\mathbf{P}; CL, T) = EC(\mathbf{P}; CL, T)_{Full\_Sim\_Default} / EC(\mathbf{P}; CL, T)_{Fixed\_EPP\_Sim\_Default}$$

The difference between calculating Economic Capital with full simulation and with a simulation using the Expected Positive Profile is described and discussed in the main text

### LOAN EQUIVALENT PROFILES AND SCALE FACTOR $\alpha$

From the above description of the calculation of the potential loss distribution due to default we can readily derive the appropriate definition of **a loan equivalent of counterparty risk for economic capital**. It is the fixed exposure profile that under simulation of defaults and recoveries generates the same economic capital as generated by full simulation.

*It is not necessary for the potential loss distribution calculated by full simulation and the potential loss distribution calculated by fixed exposure profiles to be identical at each confidence level. It is only necessary that the two loss distributions share one aspect in common: the difference between the loss at the confidence level used for economic capital and the expected loss should be identical for the two distributions.*

Note that just as the loan equivalent of counterparty risk for economic capital will depend on the confidence level and the characteristics of the portfolio, it may also

<sup>4</sup> I have made use of the fact that the Economic Capital of the set of fixed exposure profiles  $\{\alpha * EPP_k(t)\}$  is equal to  $\alpha$  times the Economic Capital of the set of fixed exposure profiles  $\{EPP_k(t)\}$ .

depend on whether Economic Capital is defined from a default only perspective (as above) or a loss of economic value perspective (as described above).

### Scale Factor $\alpha$

We thus see another way of expressing  $\alpha$ , defined above as the ratio of Economic Capital due to default and recoveries calculated with full simulation to the Economic Capital calculated with Expected Positive Profiles:

Let us define:

$LEP_k(\mathbf{P}; CL, T)$  = Loan Equivalent Exposure Profile of counterparty k, calculated under full simulation – i.e. the Fixed Profile for each counterparty that results in the same economic capital due to default and recovery as derived by full simulation.

$EPP_k$  = Expected Positive Exposure Profile of counterparty k (see definition above)

Then

$LEP_k(\mathbf{P}; CL, T)$	=	$\alpha(\mathbf{P}; CL, T) * EPP_k$
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Where  $\alpha$ ,  $\mathbf{P}$ , CL and T are defined as above.

The scale factor,  $\alpha$ , will depend on the composition of the portfolio as well as both the confidence level and the time horizon over which Economic Capital is defined.

A bank can specify  $\alpha$  for all obligors with counterparty exposure, based on the general characteristics of the total portfolio of all obligors. This would be appropriate for measuring total regulatory risk weighted assets for counterparty risk. In principal, a bank could also specify  $\alpha$  as a function of some characteristic of a sub-group of counterparties, such as their risk rating. The difficulty with the latter is that since  $\alpha$  depends on the characteristics of the portfolio for which it is measured, including the degree of portfolio diversification, it may be difficult to consistently define  $\alpha$  for subsets of counterparties.

**ANNEX 3 - CALCULATION OF  
ECONOMIC CAPITAL BASED  
ON EPE**

## CALCULATION OF ECONOMIC CAPITAL BASED ON EPE

OTC derivative counterparty exposures are variable and driven by market risk factors (mainly the principal components of the most liquid interest and foreign exchange rates, commodities and equities prices). The tail of the probability distribution of potential credit losses over a certain time horizon is determined primarily by the credit and market concentrations in the portfolio of counterparty exposures.

In its response to the Basel Committee's Consultative Paper of January 2001 (CP2), ISDA has shown that, in an asymptotically fine-grained portfolio of exposures with zero market-induced correlation on average, the economic capital could be calculated based on the expected positive exposure (EPE) to each counterparty. This proposal is in contrast, for example, to an alternative where capital is based on high confidence-level counterparty potential exposures (e.g. at 95% or 99% confidence levels).

In this paper, we describe a model to represent a portfolio of OTC derivatives counterparty exposures and estimate the proper equivalence factor  $\alpha$  to be applied to EPE for the calculation of the economic capital of a portfolio of finite and possibly correlated counterparty exposures.

The factor  $\alpha$  has been defined by Evan Picoult (Citigroup) as the ratio **A/B** where:

**A** = 99.9%-confidence default-only loss based on coherent simulation of a portfolio of counterparty exposures;

**B** = 99.9%-confidence default-only loss based on the expected positive exposure (EPE) to each counterparty.

Our model retains the essential elements of the risk dynamics of market-driven exposures and yet it is sufficiently simple and flexible to allow for the isolation of the fundamental structural characteristics of portfolios of exposures and the measurement of the sensitivity of  $\alpha$  with respect to each of them.

Specifically, we look into how  $\alpha$  varies with respect to:

1. Initial level of current exposures;
2. Correlation among default drivers in a normal 1-factor asset model;
3. Number of market risk factors driving the counterparty exposures;
4. Granularity of the portfolio of counterparty exposures;
5. Number of counterparties;
6. Number of margined counterparties
7. Probability of default of the counterparties over the horizon;
8. Confidence level used to define economic capital.

Our results suggest that, for a typical portfolio held by a large derivatives dealer,  $\alpha$  is most likely to be in the range of 1.0 to 1.25. Only in a few extreme portfolio configurations  $\alpha$  is larger than 1.5.

## D) A MODEL FOR DERIVATIVES COUNTERPARTY CREDIT RISK

### **2-date factor model for market-driven exposures**

We assume a portfolio of  $i=1, \dots, N$  derivatives counterparties and a 2-date model for market changes where:

- the value of the derivatives trades with each counterparty “ $i$ ” is  $V_i(0)$  at  $t=0$ ;
- the value of the trades with each counterparty at  $t=\text{horizon}$  is a linear function of a set of “ $K$ ” orthogonal market risk factors:

$$V_i(\text{horizon}) = V_i(0) + m_i \cdot (b_{i,1} \cdot f_1 + \dots + b_{i,K} \cdot f_K)$$

for  $i = 1, \dots, N$

$V_i(0)$  is determined by the current exposure (CE) parameter:

- $V_i(0) = -\text{CE}$ , for “ $i$ ” equal to an odd number ( $i=1,3,5,\dots$ );
- $V_i(0) = +\text{CE}$ , for “ $i$ ” equal to an even number ( $i=2,4,6,\dots$ ).

According with this specification, half of the counterparties start with mark-to-market value equal to  $+\text{CE}$  and half of the counterparties with mark-to-market value equal to  $-\text{CE}$ .

When examining the sensitivity of  $\alpha$  to granularity, we assume that the  $\log(m_i)$ 's are independent (across counterparties  $i$ 's) normal random variables with mean  $-G^2/2$  and variance  $G^2$ . “ $G$ ” defines the amount of dispersion of the standard deviations of  $V_i(\text{horizon})$ ,  $i=1, \dots, N$ . Such dispersion breaks the homogeneity of the portfolio and makes some counterparty exposures more volatile (“larger”) than others. Larger “ $G$ ’s” imply more granular portfolios of market-driven counterparty exposures.

### **Factor sensitivities**

All factor sensitivities are independent, randomly generated by the following scheme:

- 1) for each counterparty “ $i$ ”, we generate  $b_{i,k} = 2(U_{i,k}-0.5)$  for  $k=1, \dots, K$ ; “ $U$ ” is a random variable uniformly distributed on  $[0,1]$ ; all  $U_{i,k}$ 's are independent;
- 2) we then normalize the vector  $(b_{i,1}, \dots, b_{i,K})$  of counterparty's sensitivities by dividing each  $b_{i,k}$  by  $\sqrt{\sum_k b_{i,k}^2}$ .

After normalization, each counterparty's vector of market factor sensitivities has norm equal to one. Moreover, the expected value of the sum (across counterparties) of sensitivities to each market risk factor is zero (balanced book, on average).

### **Margined counterparties**

Margined counterparties could induce concentration of exposures by creating a “one-sided exposure book”. This would be the case, for example, if a dealer predominantly paid fixed in interest-rate swaps with customers (unmargined) and hedged its market risk by receiving floating in offsetting swaps with other dealers (margined). In that

case, the exposures to counterparties would be concentrated in scenarios where interest rates go up. When exposures are generated by “many” market risk factors, the one-side-book effect tends to be reduced by diversification.

We examine the effect of margining in the context of our model by allowing different degrees of one-sided book.

Let “m” be the fraction of margined counterparties on one side of the book. “m” is defined as the ratio of the number of margined counterparties by the number of counterparties on one side of the book.

If  $m=0$ , the exposure book is balanced; i.e. all counterparties in the book are unmargined.

If  $m=1$ , the exposure book is fully one-sided; i.e. half of counterparties, which are on the same side of the book, are margined.

We define “the same side of the book” based on the sign of the cosine of the hyper-angle between the vectors of sensitivities  $b_i$ 's. Counterparty “i” is on the same side of the book as counterparty “1” if the cosine of the hyper-angle between  $b_1$  and  $b_i$  is positive.

Once we have defined the two “sides” of the book, we randomly choose a fraction “m” of the counterparties on one side of the book to be margined with zero initial and variation margin thresholds. The exposures (current and potential) to margined counterparties are identically equal to zero.

### **Simulation of market-driven exposures-at-default**

We simulate  $j=1, \dots, 2000$  market scenarios. Each market scenario corresponds to a realization of the “K” independent market risk factors  $f_{1,j}, \dots, f_{K,j}$ . Each market risk factor has a standard normal distribution with mean equal to zero and variance equal to one. The values of the positions with each and all counterparties ( $V_i(\text{horizon})$ ) are computed by the linear model above. All  $V_i(\text{horizon})$ ,  $i=1, \dots, N$ , have normal distributions with mean equal to  $V_i(0)$  and variance equal to  $m_i$ . When  $G=0$ , all  $m_i$ 's are equal to one. The exposure-at-default  $E_{i,j}$  to each counterparty “i” in market scenario “j” is:

$$E_{i,j} = \max(V_i(\text{horizon}), 0)$$

After the market simulation is concluded, we have a matrix (2000 x N) of N counterparty exposures in each of 2000 market scenarios. Each row of the matrix corresponds to a set of coherent counterparty exposures, i.e., exposures generated by the same market scenario.

Based on this matrix we compute the expected positive exposure (EPE) to each counterparty:

$$EPE_i = \sum_j E_{i,j} / 2000$$

When “G” and “CE” are equal to zero, the expected exposures to all counterparties are the same (within the random error of the simulation) and equal to 0.3989.

When  $CE \neq 0$ , there are two values of expected exposures: one for the “i” odd counterparties and another for the “i” even counterparties. The effect of  $CE \neq 0$  is important because it creates volatility in the exposure to defaulted counterparties even when capital is calculated via the EPE-based simulation. That is, the total exposure to defaulted counterparties in each credit scenario depends on the specific set of counterparties that defaulted. In the limit, when CE is large, the volatility created by the binary  $EPE_i$ 's dominates the market-induced volatility and  $\alpha$  converges to one.

In typical dealers' portfolios of counterparty exposures, the EPEs can vary quite a lot across counterparties. The variability of EPEs can be large when compared to market-induced variability of exposures. This tends to reduce  $\alpha$  toward one. Our model captures some, but not all, of the attenuating effect of CE on  $\alpha$ . Thus, we expect the  $\alpha$ 's produced by our model to be higher than the ones of real portfolios with more heterogeneity of EPEs across counterparties.

### Simulation of default events

The probability of default “PD” over the horizon is the same for all counterparties. The recovery rates are also the same and are assumed to be zero for all counterparties. Those assumptions are consistent with the definition of a homogeneous portfolio.

We simulate  $h=1, \dots, 200,000$  credit scenarios each consisting of a random set of counterparties that default.

Default scenarios are independent of market scenarios. That is, we assume away right-way and wrong-way exposures.

When examining the sensitivity of  $\alpha$  to the correlation among counterparty defaults, we use the following one-factor asset-based default model:

Let “ $A_i$ ” be the default driver for counterparty “i”.

$$A_i = \sqrt{R} \cdot Z_f + \sqrt{1 - R} \cdot Z_i$$

where

“R” is the constant pairwise correlation among default drivers;

“ $Z_f$ ” is a  $N(0,1)$  systematic risk factor driving defaults;

“ $Z_i$ ” are independent  $N(0,1)$  idiosyncratic random drivers (i.e. specific default driver for counterparty “i”);

For each credit scenario “h” we simulate  $Z_f$  and  $Z_i$ ,  $i=1,\dots,N$ . A counterparty defaults if  $A_{i,h} < N^{-1}(PD)$ .

### Computation of “full simulation” economic capital

For each credit scenario, we randomly select one single market scenario and compute the portfolio default losses by adding up the exposures to the counterparties that have defaulted in the credit scenario. Since we have 200,000 default scenarios and 2,000 market scenarios, we expect that each market scenario “j” will be randomly selected about 100 times.

Observe that the portfolio loss in each credit scenario “h” is subject to two sources of randomness:

- a) the number of default events in the credit scenario (default volatility);
- b) the sum of the exposures to the defaulted counterparties in the credit/market scenario (exposure volatility).

### Computation of EPE economic capital

For each credit scenario generated for the “full simulation”, we compute the total default losses by adding up the expected exposures to the counterparties that have defaulted.

Observe that the portfolio loss in each credit scenario “h” is subject to the same two sources of randomness mentioned above. In the case of  $CE=0$ , there is no exposure volatility; i.e., all  $EPE_i$ 's are the same.

## II) SENSITIVITY ANALYSIS

### Base case

We define a base case that we consider representative of a large dealer:

- number of “effective” market risk factors = 3
- number of “effective” counterparties = 200
- $PD = 0.0030$
- “homogeneous” portfolio:  $[V_i(t=\text{horizon}) - V_i(t=0)]$  is  $N(0,1)$  for  $i=1,\dots,N$
- 1-factor credit model with asset correlations 0.22;
- $CE = 1.36$  which implies, in our model, that the ratio of the maximum potential (95%, over 1 year) and current exposures of the portfolio is 1.30;
- Economic capital defined at 99.9% statistical confidence level

**$\alpha$  is equal to 1.09 in the base case**

In the sensitivity analysis to follow, the model parameters are kept as specified in the base case unless explicitly modified.

### 1) Sensitivity of $\alpha$ to the pairwise correlation between default drivers

<b>R</b>	<b>stdev(<math>n_h</math>)</b>	<b><math>n_h(99.9\%)</math></b>	<b><math>\alpha</math></b>
0.00	0.77	4	1.43
0.12	1.11	9	1.21
<b>0.22</b>	<b>1.51</b>	<b>15</b>	<b>1.09 (base case)</b>
0.24	1.60	17	1.08
0.50	3.20	44	1.02

“R” is the pairwise correlation between default drivers;

“stdev( $n_h$ )” is the standard deviation of the number of default events that occur in each credit scenario “h”;

“ $n_h(99.9\%)$ ” is the 99.9-percentile of the distribution of the number of defaults ( $n_h$ ) in each credit scenario. It is a metric of the extension of the tail the distribution of the number of defaults.

The correlation among defaults is a key determinant of  $\alpha$ . The stronger the correlation is, the higher the variability of the number of defaults across credit scenarios.  $\alpha$  converges to one: its numerator and denominator are driven by the variability of the number of defaults and the variability of exposures becomes less relevant.

### 2) Sensitivity of $\alpha$ to the level of current exposures

<b>CE</b>	<b>MPE/CE</b>	<b>avg(<math>EE_i</math>)</b>	<b><math>\alpha</math></b>
0	--	0.401	1.35
1	1.60	0.584	1.14
<b>1.36</b>	<b>1.30</b>	<b>0.720</b>	<b>1.09 (base case)</b>
2	1.09	1.009	1.05
3	1.05	1.501	1.03

“CE” is the initial level of mark-to-market value as outlined in the model specification above;

“MPE/CE” is the ratio of the maximum potential (95%, over 1 year) and current exposures of the portfolio;

“avg( $EE_i$ )” is the average expected exposure across counterparties. Observe that in the extreme case of CE=3, avg( $EE_i$ )=1.5 as expected.

The higher the CE is, the higher the variability of the sum of  $EPE_i$ 's to the counterparties that default.  $\alpha$  converges to one because its numerator and denominator are dominated by the variability of  $EPE_i$ 's.

Example: when CE=3, half of the counterparties have EPE equal to 3 and half of the counterparties have EPE equal to zero. Suppose that there are 15 default events in a tail credit scenario; the variance of the total exposure conditional on 15 default events is:  $15 \times 0.5 \times 0.5 \times (3-0)^2 = 33.75$  and its standard deviation is 5.81. Compare that number with the market-induced variance of exposures conditional on 15 defaults:  $7.5 \times 1^2 = 7.5$ . Conclusion: the variability of the sum of EPE<sub>i</sub>s is much larger than the additional variability introduced by the market risk factors.

### 3) Sensitivity of $\alpha$ to the number of market risk factors (K)

K	avgCorr	$\alpha$
1	0.164	1.10
<b>3</b>	<b>0.048</b>	<b>1.09 (base case)</b>
5	0.029	1.08
10	0.015	1.08
50	0.002	1.08

“K” is the number of orthogonal market risk factors;

“avgCorr” is the average pairwise correlation of counterparty exposures induced by the finite (and possibly small) number of market risk factors.

The number of orthogonal (i.e. uncorrelated) market risk factors determines the average level of pairwise correlations between market-driven counterparty exposures. A large number of orthogonal market risk factors reduce the average pairwise correlation and the variability of the sum of market-driven exposures. Consequently,  $\alpha$  decreases.

### 4) Sensitivity of $\alpha$ to the granularity of the portfolio of counterparty exposures (heterogeneous portfolio)

G	1/H	MPE/CE	max/min	$\alpha$
<b>0.0</b>	<b>200</b>	<b>1.30</b>	<b>1</b>	<b>1.09 (base case)</b>
0.5	157	1.36	8	1.10
1.0	86	1.46	69	1.21
1.5	33	1.56	577	1.34

“G” is a measure of the dispersion of the sensitivities of the counterparty positions to the market risk factors. The larger “G” is, the more heterogeneous is the portfolio of counterparty exposures in terms of their responses to changes in market risk factors;

“H” is the *Herfindahl concentration index* of counterparty sensitivities to markets and “1/H” can be interpreted as the effective number of counterparties in the portfolio, i.e., the number of counterparties in a homogeneous portfolio that would have the same H as the granular portfolio;

“MPE/CE” is the ratio of the maximum potential (95%, over 1 year) and current exposures of the portfolio;

“max/min” is the ratio of the 99-percentile over the 1-percentile of the probability distribution of  $m_i$ 's. When  $G=1$ , the 99% largest exposure is 104 times larger than the 1% smallest.

Granularity in the “deltas” of counterparty exposures to market risk factors is an important determinant of  $\alpha$ . The variability of the market-driven exposures increases because of the higher heterogeneity in the magnitudes of the market-driven potential exposures.

#### 5) Sensitivity of $\alpha$ to the number counterparties (N)

N	$\alpha$
20	1.26
50	1.22
100	1.10
<b>200</b>	<b>1.09 (base case)</b>
500	1.04

A higher number of counterparties causes a higher number of defaults  $n_h$  per credit scenario “h”. A higher number of defaults causes the variability of the sum of weakly correlated exposures to counterparties to decrease relative to the sum of the  $EPE_i$ 's.

#### 6) Sensitivity of $\alpha$ to the fraction of margined counterparties (m) in one side of the book

m	MPE/CE	$\alpha$
<b>0.00</b>	<b>1.30</b>	<b>1.09 (base case)</b>
0.25	1.30	1.10
0.50	1.36	1.11
0.75	1.54	1.18
1.00	1.83	1.24

A higher fraction of margined counterparties on one side of the book induces concentration of exposures. The concentration is mitigated by the diversification across  $K=3$  independent market risk factors.

With  $K=1$  and  $m=1$  (most extreme case),  $\alpha$  is 1.42.

#### 7) Sensitivity of $\alpha$ to the probability of default (PD)

PD	$\alpha$
0.001	1.17
<b>0.003</b>	<b>1.09 (base case)</b>
0.005	1.07
0.01	1.06
0.05	1.05

A higher probability of default “PD” causes a higher expected number of defaults  $n_h$  per credit scenario “h”. The higher number of defaults causes the variability of the total exposures to defaulted counterparties to decrease relative to the sum of the  $EPE_i$ ’s.

### 8) Sensitivity of $\alpha$ to the confidence level defining economic capital

confidence level	$\alpha$
99.0%	1.07
99.5%	1.10
<b>99.9%</b>	<b>1.09 (base case)</b>

The non-monotonic behavior of  $\alpha$  with respect to the level of confidence used to define economic capital stems primarily from the shape of the tail of the loss distribution in the EPE-based calculation. The tail of the EPE-based loss distribution displays “discontinuities” corresponding to the discreteness of the probability distribution of the number of defaults per credit scenario.

# ANNEX 4 - ANALYTIC $\alpha$ CALCULATIONS

## ANALYTIC $\alpha$ CALCULATIONS

### 1. Summary

As explained at III, main text, work has been done by both members of the ISDA counterparty risk working group and independently by Michael Gibson at the Federal Reserve Board<sup>5</sup>, to assess the additional capital required within ISDA's EPE framework for risks not covered in the original response<sup>6</sup>. To discuss this work we refer to a quantity  $\alpha$  defined as the ratio  $A/B$  where:

- $A$ : = 99.9% loss with correlated market positions and stochastic exposures.
- $B$ : = 99.9% loss for a corresponding portfolio with fixed exposures equal to EPE.

Michael Gibson's work is presented in terms of the understatement  $U$  of the standard deviation of the loss distribution, which is used to assess approximately the understatement of risk at the 99.9<sup>th</sup> percentile. For comparison with our work, we redefine  $U$  here as the equivalent direct concept, the understatement of the 99.9% confidence point. Then  $U$  is related to  $\alpha$  by

$$\alpha = 1 + U$$

In this way, Gibson's and ISDA's results are made directly comparable. ISDA's work has been both numerical (see Annex 3) and theoretical (as presented below) with good agreement between the methods. Furthermore, except for its use of the granularity adjustment technique instead of scaling by variances to obtain exact limiting values for  $\alpha$ , ISDA's theoretical work is conceptually very similar to Gibson's and the whole therefore appears to represent a conceptual consensus.

In this Annex,

- We present values of  $\alpha$  obtained using ISDA's theoretical method and compare these to the simulation results set out in Annex 3. Agreement between theory and simulation is close. See Attachment 1.
- We provide further values of  $\alpha$  using Michael Gibson's formulae, which essentially corresponds to the case of an infinitely granular portfolio. See Attachment 2. These values of  $\alpha$  are smaller than those obtained by ISDA, due to the reference to an infinite portfolio.
- The methodology for ISDA's analytic results is presented and compared with Michael Gibson's formulae.

### 2. Analytic calculations for ISDA's $\alpha$ simulations

Eduardo Canabarro's simulations (Annex 3) determine  $\alpha$  with various parameter combinations, using a model in which default rates are driven by a single factor conceptually consistent with both the IRB approach and the framework underlying ISDA's original proposals on EPE.

<sup>5</sup> Michael Gibson, "Regulatory Capital for counterparty credit risk: A response to ISDA's proposal" Federal Reserve Board, transmitted 15 November, 2002. Throughout, references to Gibson are to this article.

<sup>6</sup> We are not referring to wrong way risk which is discussed separately at II in the main body of this document.

We give an analytic version of most of these simulations using the granularity adjustment method. Results are close to and support Eduardo's results.

### Set-up

The set-up for Eduardo's work is as follows:

- $N$  counterparties in a Vasicek one factor model conceptually consistent with IRB.
- We consider a one period model i.e. values are taken at the horizon. Exposure is  $E(1) = \max(0, V(1))$  where  $V$  is market value at one year.
- We work to a standardized  $\sigma = 1$  and opening values are expressed as multiples of  $\sigma$ . In the set up current exposure  $V(0) = CE = \pm u$  where  $u = 1.36$  in the "base case".

### Results

See Attachment 1.

- Results agree closely to Eduardo's.
- We have not performed the set of results for non zero G (Set 4) as this involves extra difficulties.

### Note on validity of results and calculations

Results are first order approximations in  $(1 / N)$  and in  $c$  respectively, where  $N$  is the number of obligors and  $c$  the average covariance between their market values. The slopes with respect to these parameters are exact, but for  $1/N, c \neq 0$  these are not exact and accordingly should be seen as supplementary to the simulation results presented in Annex 3, providing an alternative point of view on the "ingredients" affecting  $\alpha$ .

### **Calculation approach**

$\alpha$  is defined as a ratio A/ B where:

A: = 99.9% loss using full simulation with correlated market positions and stochastic exposures

B: = 99.9% loss for a corresponding portfolio with fixed exposures equal to EPE.

The approach here is to calculate both these percentiles using the granularity adjustment approach

$$t_{99.9\%} = \mu(x_{99.9\%}) + \beta(x_{99.9\%})$$

where the summands are the systematic risk and granularity adjustment, evaluated at the 99.9% value of the systematic variable X The quantity  $\alpha$  is then the ratio of percentiles.

The systematic risk is the same in each case, since as was shown in the ISDA response it is given by EPE. The relevant calculations of the granularity adjustment for the Vasicek model have already been done so nothing essentially new is needed here – see Attachment 4. The difficulty lies in calculating the conditional variance of the portfolio due to exposure covariance in Case A, when exposures are correlated. Note that unlike ISDA's response to CP2, Annex 1, we need to work here in the simpler one period model i.e. we only consider values at time  $t = 1$ , rather than over the interval  $0 \leq t \leq 1$ . This one period approach displays all the main features of the more complex continuous time approach and is consistent with the simulation work described in Annex 3. Applying the results from ISDA's response to CP2, Annex 1, to the one period case we have conditional on the value of the systematic factor X

$$\mu(x) = \sum_A E_A P_A \text{ and } \sigma^2(x) = \sum_A F_A^2 P_A (1 - P_A) + \sum_{A,B} P_A P_B \text{cov}(E_A(1), E_B(1)) \quad (1)$$

where  $E_A, F_A$  are the expected positive exposure and RMS exposure respectively<sup>7</sup> We write  $P_A$  for  $P_A(x)$ , the default probability conditional on the systematic factor. As remarked  $\mu$  is the same in both case A and case B.

In a portfolio of  $N$  assets and homogeneous with respect to credit quality,  $P_A \equiv P$  is independent of A and (1) becomes

$$\mu(x) = N \langle E \rangle P(x) \quad (2)$$

and

$$\sigma^2(x) = N \langle F^2 \rangle P - N \langle F^2 \rangle P^2 + N(\langle F^2 \rangle - \langle E^2 \rangle) P^2 + N(N-1) P^2 c$$

which simplifies to

$$\sigma^2(x) = N \langle F^2 \rangle P - N \langle E^2 \rangle P^2 + N(N-1) P^2 c \quad (3)$$

where the brackets denote average values over the portfolio, e.g.  $\langle F_A^2 \rangle = \frac{1}{N} \sum_A F_A^2$  and,

(Michael Gibson's notation from equation A.10 of his paper),

$$c := \langle \text{Cov}(E_A(1), E_B(1)) \rangle \quad (4)$$

is the average covariance between distinct exposures (we have eliminated the diagonal term using the relationship  $\text{Var}(E_A(1)) = F_A^2 - E_A^2$  which holds in the one period model).

We need to calculate all the terms of  $\sigma^2$ . The most difficult is the exposure covariance term  $c$  which we deal with next.

### Exposure covariance

Non zero average covariance between exposures arises due to scattering of the correlations between pairs of assets around zero, because exposure covariance is a convex function of market covariance. In addition, scenarios have been considered in Annex 3 in which counterparties with different positions have differential tendency to be margined. This gives rise to direct exposure covariance, the effect of which can also be calculated using the methods presented here, but we have not included these calculations in the below.

Let the market values for distinct obligors A and B at time  $t$  be  $V_{A,B}(t)$ . We consider a one period model with  $t = 0, 1$  and write  $x, y$  for the changes in market values over the period. Let these have correlation  $\rho$  (i.e.  $\rho$  is the market value correlation). Then (in the one period setting):

$$\text{Cov}(E_A(1), E_B(1)) = \iint \max(0, V_A(0) + x) \max(0, V_B(0) + y) n(x, y, \rho) dx dy - E_A E_B \quad (5)$$

where  $n(x, y, \rho)$  is the bivariate standard normal density. We evaluate this as a power series in  $\rho$  using the tetrachoric expansion (see Abramowitz and Stegun, §26.3.29). After integrating term-wise, using integration by parts, this gives:

$$c_{AB} = \text{Cov}(E_A(1), E_B(1)) = \sum_{m=0}^{\infty} \frac{\rho^{m+1}}{(m+1)!} N^{(m)}(V_A(0)) N^{(m)}(V_B(0)) \quad (6)$$

<sup>7</sup> Throughout, exposures without time arguments, i.e.  $E_A$  and later  $E_+$ ,  $E$ . refer to  $EPE$  and likewise  $F$  refers to RMSE, while  $E_A(1)$  etc means actual exposure at time  $t = 1$ .

where  $N$  is the standard normal cumulative density. The linear term will contribute nothing on taking expectations. Working to “first order” we will only take the quadratic term, arriving at:

$$Cov(E_A(1), E_B(1)) = \frac{\rho^2}{2} n(V_A(0))n(V_B(0)) \quad (7)$$

where  $n$  is the standard normal density.

We now take expectations. Here we assume that correlations are independent of current exposure levels (Eduardo’s simulations specify the current exposure levels as +/-  $u$  independent of positions, so this assumption is correct, and indeed it is generally a reasonable assumption). Then to first order:

$$c = \frac{1}{2} \langle n(V_A(0)) \rangle \langle n(V_B(0)) \rangle \langle \rho^2 \rangle \quad (8)$$

where as above, the brackets refer to averaging across the portfolio of obligors.

Relationship to the number of market factors

In Annex 3 it is assumed that, independent of the number  $N$  of obligors, there is a fixed number  $K$  of market factors in which obligors take positions at random<sup>8</sup>.

Thus suppose  $A$  and  $B$  have exposures depending on  $K$  orthogonalised market factors represented by normalised independent r.v.'s  $\theta_{Ak}$ . Thus for all  $A$ :

$$V_A(1) = V_A(0) + \sum_{i=1}^K \theta_{Ak} X_k \text{ where } \sum_{i=1}^K \theta_{Ak}^2 = 1 \quad (9)$$

Then the correlation  $\rho$  between  $V_A$  and  $V_B$  is

$$\rho_{AB} = \sum_{i=1}^K \theta_{Ak} \theta_{Bk} \quad (10)$$

We need the mean square of this correlation across the portfolio (denoted by brackets as before):

$$\langle \rho^2 \rangle = \langle (\sum_{i=1}^K \theta_{Ak} \theta_{Bk})^2 \rangle = \sum_{i=1}^K \langle \theta_{Ak}^2 \rangle \langle \theta_{Bk}^2 \rangle = \frac{K}{K^2} = \frac{1}{K} \quad (11)$$

where we have used  $\sum_{i=1}^K \theta_{Ak}^2 = 1$  to derive  $\langle \theta_{Ak}^2 \rangle = 1/K$ , given that the positions are chosen at random. Substituting in (8) gives

$$c = \frac{\langle n(V_A(0)) \rangle \langle n(V_B(0)) \rangle}{2K} \quad (12)$$

for  $A \neq B$ . Finally, in the test portfolios (Annex 3) we have  $V_A(0) = \pm u$  for a specified  $u$ , and we arrive at last at a simple formula relating average covariance to the number of underlying factors:

$$c = \frac{n(u)^2}{2K} \quad (13)$$

**Other terms**

The following auxiliary calculations are essentially in the original ISDA document on counterparty risk.. In the simulations each current exposure is one of  $\pm u$  and we use this to simplify the calculations, as above. We write subscript +/- to distinguish the two cases. We have:

*Expected exposures (EPE)*

$$E_+ = uN(u) + n(u) \text{ and } E_- = -uN(-u) + n(u) \quad (14)$$

*RMS exposures*

$$F_+^2 = (u^2 + 1)N(u) + un(u) \text{ and } F_-^2 = (u^2 + 1)N(-u) - un(u) \quad (15)$$

We shall need:

$$F_+^2 + F_-^2 = u^2 + 1 \quad (16)$$

**Conditional mean and variance**

We can now put these together to write down the conditional mean and variance of the loss distribution given the value of the systematic variable  $X$ . By (2) – (3):

$$\mu(x) = N \langle E \rangle P(x) \quad (17)$$

$$\sigma^2(x) = N \langle F^2 \rangle P(x) - N \langle E^2 \rangle P(x)^2 + N(N-1)P(x)^2 c \quad (18)$$

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<sup>8</sup> This approach avoids the difficulty noted by Gibson (A-1) of specifying the expanded correlation structure as  $N$  is increased. This is similar to the underlying approach for one factor modelling, where by viewing correlation as arising via coupling to a systematic variable one can specify that new obligors are identical to the old ones, rather than worrying about creating new correlations for them.

We now write these out explicitly in Eduardo's cases:

Case (A): Portfolio considered as consisting of fixed exposures equal to EPE.

Then

$$\mu(x) = \frac{N}{2}(E_+ + E_-)P \quad (19)$$

$$\sigma^2(x) = \frac{N}{2}(E_+^2 + E_-^2)P(1-P) \quad (20)$$

Case (B): Actual (correlated stochastic) exposures

We have from (2):  $\mu(x) = \frac{N}{2}(E_+ + E_-)P$  as before (21)

Using (3), (13) and (16), we also have

$$\sigma^2(x) = \frac{N}{2}(u^2 + 1)P + \left[-\frac{N}{2}(E_+^2 + E_-^2) + N(N-1)\frac{n(u)^2}{2K}\right]P^2 \quad (22)$$

Obtaining the percentiles, and hence  $\alpha$

In both cases A and B the systematic risk is given by

$$\mu(x_{99.9\%}) = \frac{N}{2}(E_+ + E_-)P(x_{99.9\%}) \quad (23)$$

For the unsystematic risk element we use the granularity adjustment (Wilde, "Probing Granularity", RISK, August 2001, equation 4<sup>9</sup>).

$$\beta = \frac{-1}{2f_x} \frac{d}{dx} \left( \frac{f_x \sigma^2}{d\mu/dx} \right) \quad (24)$$

Where

$$\mu(x) = \varepsilon P(x) \text{ with } \varepsilon = \frac{N}{2}(E_+ + E_-) \quad (25)$$

which is fixed depending on the portfolio. Referring to the formulae above we have, both cases, the general form:

$$\sigma^2(x) = aP(x) + bP(x)^2 \quad (26)$$

Where  $a$  and  $b$  are coefficients depending on which case we are in. The calculation of the granularity adjustment in this case is dealt with in Attachment 3. We get coefficients  $\beta_a$  and  $\beta_b$  depending on the default probability, percentile confidence level and asset correlation but nothing else (and therefore which are the same for cases A and B) such that in each case:

$$t_{99.9\%} = \varepsilon P + \frac{a}{\varepsilon} \beta_a + \frac{b}{\varepsilon} \beta_b \Big|_{x=x_{99.9\%}} ; \alpha = \frac{\varepsilon P + \beta_a a(B)/\varepsilon + \beta_b b(B)/\varepsilon}{\varepsilon P + \beta_a a(A)/\varepsilon + \beta_b b(A)/\varepsilon} \Big|_{x=x_{99.9\%}} \quad (27)$$

VBA code implementing this formula and used for the results is exhibited at Attachment 2.

<sup>9</sup> See for example, Gordy, "A risk factor model for ratings based capital rules", Federal Reserve, October 2002, or Martin and Wilde "Unsystematic Credit Risk", RISK, November 2002.

### 3. Discussion of Michael Gibson's results

The results discussed here are all to be found in Section 3 of Gibson's paper.

#### Summary of Gibson's paper Section 3 (with translation to ISDA terminology)

Section 3 of Gibson assesses the impact of non zero covariances between market positions, paralleling Eduardo's work and the above to some extent. Gibson provides

- A formula for exposure covariance with given market correlation (page 6);
- A formula for the amount of understatement  $U$  of risk using EPE when exposure covariance is present, in the case when the portfolio is infinite.
- Gibson's  $U$  (with our interpretation of  $U$  as the direct understatement of percentiles) is related to ISDA's  $\alpha$  by  $\alpha - 1 = U$ , and so conveys the same information.

Brief conclusions on this and its relation to ISDA's work are as follows:

- The two ingredients (determination of the covariance  $c$  between exposures, and of the sensitivity of percentiles to  $c$ ) are the same as the two essential ingredients in the above analysis and so ISDA's work and Gibson's are in essential accord.
- Gibson has not calculated numerical values of  $U$  to compare with ISDA's, but this can easily be done using Gibson's formulae in the ISDA scenarios – see Attachment 2. Essentially, Gibson's results give lower values of understatement than ISDA's, because Gibson works in the case  $N = \infty$  while the results in Annex 3 are for a finite portfolio.
- Gibson's formula for  $U$  is based on scaling percentiles according to the impact on standard deviation. This is an approximate treatment, but often gives good results. Below, we present an exact first order formula which gives higher but not very different values for  $U$  as a function of  $c$ . **The most material difference between Gibson and ISDA is therefore not to do with  $c$  but arises in respect of assumptions about  $N$ , the number of obligors.**

Attachment 2 shows results in the Gibson case obtained using respectively Gibson's formula (32) and the exact first derivative formula (39) for the coefficient  $\alpha_{Gib}$ .

#### Gibson's formula for covariance between exposures

For all the calculations presented below, the covariance  $c$  is calculated using equation (7) which is valid for arbitrary spot exposures. Gibson also gives a closed formula for covariance between exposures when both spot values are zero, which we digress briefly to consider. In our notation, and in terms of covariance, Gibson's formula<sup>10</sup> Page 6 is:

$$c = \rho \left( \frac{1}{4} + \frac{1}{2\pi} \sin^{-1} \rho \right) + \frac{\sqrt{1 - \rho^2} - 1}{2\pi} \quad (28)$$

Gibson presents his formula as holding between averages over time  $\frac{1}{T} \int E_A dt$  and  $\frac{1}{T} \int E_B dt$ , but seems to assume that  $V_A(t) = \sigma_A \sqrt{t} X_A$  for a (single) random variable  $X_A$ , and similarly for B. This assumption is not very realistic for the time development of value, which might more reasonably be assumed to follow Brownian motion. Nevertheless the equation above holds good as a one period equation, and all our

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<sup>10</sup> Michael Gibson, page 6.

results have in any case been in the one period case. In that case, in fact (28) is the sum of the tetrachoric series (6) when both exposures are zero.

Note however that, under the more realistic assumption that the values  $V_A$  and  $V_B$  follow correlated Brownian motion, i.e.

$$dV_{A,B}(t) = \sigma_{A,B} d\omega_{A,B}; \quad d\omega_A d\omega_B = \rho dt$$

the formula for covariance between time averages is as follows<sup>11</sup>:

$$c = \frac{\rho}{12} - \frac{32}{9.16\pi} + \frac{\rho(10\rho^2 - 1)\sqrt{1 - \rho^2} + (8\rho^4 + 1)\sin^{-1} \rho}{3.16\pi\rho^3} \quad (29)$$

Incidentally, when  $A = B$  and  $\rho = 1$ , this formula gives rise to variance of the time averaged exposure of

$$c = \frac{51\pi - 64}{288\pi} \approx 0.1 \quad (30)$$

This formula appears at footnote 5 in ISDA's 2001 response.

#### Gibson's formula for understatement ( $U$ ) in terms of exposure covariance

We turn to the calculation of understatement  $U = \alpha - 1$ . In our notation, Gibson estimates the understatement  $U$  of risk arising from neglecting counterparty exposure correlation as

$$U \cong \alpha_{Gib} \frac{c}{\langle E \rangle^2} \quad (31)$$

where  $\langle E \rangle$  is the average EPE in the portfolio and  $c$  is the average covariance between exposures as defined earlier<sup>12</sup>. The coefficient is called  $\alpha$  by Gibson, so to avoid confusion with ISDA's  $\alpha = 1 + U$  we refer to this coefficient as "Gibson's  $\alpha$ " denoted  $\alpha_{Gib}$ . As mentioned, Gibson uses standard deviation scaling to estimate this coefficient and derives the result:

$$\alpha_{Gib} = \frac{1 \mathbf{E}(q(X)^2)}{2 \sigma^2(q(X))} \quad (32)$$

Gibson remarks that we typically have  $0.6 \leq \alpha_{Gib} \leq 0.8$  approximately, and this is borne out by the examples in Annex 3 when formula (32) is used. The exact formula for understatement of percentiles (see below) gives similar but somewhat higher values, which unlike equation (32) depend on the confidence level.

We may alternatively write (32) as:

$$\alpha_{Gib} = \frac{1}{2} \frac{\sigma^2(q(X)) + \mu^2(q(X))}{\sigma^2(q(X))} = \frac{1}{2} \left(1 + \frac{1}{\omega^2}\right) \quad (33)$$

where  $\omega$  is the so-called default rate volatility (an explicit input into the CreditRisk+ model, or a function of asset correlation in the Vasicek model). Typical values of  $\omega$  in the Vasicek model are 150% – 300% for investment grade assets, which correspond to values of  $\alpha_{Gib}$  (calculated by this formula) in the range 0.55 – 0.72, consistent with Gibson's suggested range of 0.6 – 0.8.

#### The true value of $\alpha_{Gib}$ for small $c$

<sup>11</sup> Tom Wilde, calculations communicated to the CRWG, March 2002.

<sup>12</sup> Michael Gibson, equation (1), page 5 or equation (A.29). Take care to note that (in our notation), we want  $\langle E \rangle^2$ , not  $\langle E^2 \rangle$  which appeared earlier.

Gibson's derivation of the coefficient  $\alpha_{Gib}$  is based on comparing standard deviations of the distributions of loss with and without covariance. Our value, based directly on the understatement of percentiles, depends on the confidence level, which equation (32) does not. The method we have already used for Eduardo's calculation gives this value, as follows:

By definition (referring to the direct assessment of percentile understatement):

$$\alpha_{Gib} = \frac{1}{\langle E \rangle^2} \left. \frac{dt}{dc} \right|_{c=0}$$

where  $t$  is the percentile of the loss distribution at given confidence. This derivative is given exactly by the granularity adjustment (24). The exact value of the  $\alpha_{Gib}$  coefficient is therefore given by taking  $N = \infty$  in formula (27). In more detail, scaling (2) and (3) to a constant total notional of 1 unit, we have:

$$\mu(x) = \langle E \rangle P(x) \quad (34)$$

$$\sigma^2(x) = (\langle F^2 \rangle P - \langle E^2 \rangle P^2) / N + (1 - 1/N) P(x)^2 c \quad (35)$$

Letting  $N \rightarrow \infty$  gives  $\sigma^2(x) = P(x)^2 c$ . By (27) left hand formula,

$$t_q(c) = \langle E \rangle P(x_q) + \frac{c}{\langle E \rangle} \beta_b(x_q) \quad (36)$$

Finally

$$U = \frac{t(c)}{t(0)} - 1 = \frac{\beta_b(x)}{\langle E \rangle^2 P(x)} c \Big|_{x=x_q} \quad (37)$$

This will be in the same form as Gibson's formula A.29 (repeated at 31 above), if we put

$$\alpha_{Gib} = \frac{\beta_b}{P} \quad (38)$$

in place of Gibson's formula (Gibson A.25) for the coefficient.

Using  $\beta_b = P(\beta_a - \frac{1}{2})$  this becomes:

$$\alpha_{Gib} = \beta_a(x_q) - \frac{1}{2} \quad (39)$$

Note this is the *exact* value  $\alpha_{Gib} = (1/\langle E \rangle^2) dt/dc|_{c=0}$  holding in the limit of small  $c$ , although it is not necessarily more valid than Gibson's value when  $c$  is large since in that case the first order approximation will not be valid, while it is generally found that variances do give a reasonable guide to the percentiles of distributions in most cases.  $\alpha_{Gib}$  computed this way lies in the range 0.8 – 1.3, above but by no means essentially different from values obtained using (32).

### Attachment 1: Agreement between $\alpha$ simulations (Annex 3) and analytic results

The scenarios are as detailed in Eduardo's notes. The right hand column shows Eduardo's values for  $\alpha$  and the red column labelled " $\alpha$ " shows results using the analysis presented here. Scenario 4 corresponding to the heterogenous portfolio is not performed.

Asset $\rho$	CE+/-	K = No factors	G	No of cpties	PD	Conf level	$\alpha$	$\alpha$ Monte Carlo
<u>Base case</u>								
22%	1.36	3	0	200	0.30%	99.9%	<b>1.08</b>	<b>1.09</b>
<u>1. Sensitivity to pairwise correlation</u>								
<b>0%</b>	1.36	3	0	200	0.3%	99.9%	<b>1.46</b>	<b>1.43</b>
<b>12%</b>	1.36	3	0	200	0.3%	99.9%	<b>1.15</b>	<b>1.21</b>
<b>24%</b>	1.36	3	0	200	0.3%	99.9%	<b>1.07</b>	<b>1.08</b>
<b>50%</b>	1.36	3	0	200	0.3%	99.9%	<b>1.02</b>	<b>1.02</b>
<u>2. Sensitivity to level of current exposures</u>								
22%	<b>0</b>	3	0	200	0.3%	99.9%	<b>1.33</b>	<b>1.35</b>
22%	<b>1</b>	3	0	200	0.3%	99.9%	<b>1.12</b>	<b>1.14</b>
22%	<b>2</b>	3	0	200	0.3%	99.9%	<b>1.04</b>	<b>1.05</b>
22%	<b>3</b>	3	0	200	0.3%	99.9%	<b>1.02</b>	<b>1.03</b>
<u>3. Sensitivity to the number of market risk factors</u>								
22%	1.36	<b>1</b>	0	200	0.3%	99.9%	<b>1.09</b>	<b>1.1</b>
22%	1.36	<b>5</b>	0	200	0.3%	99.9%	<b>1.08</b>	<b>1.08</b>
22%	1.36	<b>10</b>	0	200	0.3%	99.9%	<b>1.07</b>	<b>1.08</b>
22%	1.36	<b>50</b>	0	200	0.3%	99.9%	<b>1.07</b>	<b>1.08</b>
<u>4. Sensitivity to granularity of exposures (heterogenous portfolio)</u>								
22%	1.36	3	<b>0.5</b>	200	0.3%	99.9%		<b>1.08</b>
22%	1.36	3	<b>1.0</b>	200	0.3%	99.9%		<b>1.21</b>
22%	1.36	3	<b>1.5</b>	200	0.3%	99.9%		<b>1.34</b>
22%	1.36	3	<b>2.0</b>	200	0.3%	99.9%		<b>1.21</b>
<u>5. Sensitivity to number of counterparties</u>								
22%	1.36	3	0	<b>20</b>	0.3%	99.9%	<b>1.31</b>	<b>1.26</b>
22%	1.36	3	0	<b>50</b>	0.3%	99.9%	<b>1.20</b>	<b>1.22</b>
22%	1.36	3	0	<b>100</b>	0.3%	99.9%	<b>1.13</b>	<b>1.1</b>
22%	1.36	3	0	<b>500</b>	0.3%	99.9%	<b>1.04</b>	<b>1.04</b>
<u>6. Sensitivity to probability of default</u>								
22%	1.36	3	0	200	<b>0.1%</b>	99.9%	<b>1.12</b>	<b>1.17</b>
22%	1.36	3	0	200	<b>0.5%</b>	99.9%	<b>1.06</b>	<b>1.07</b>
22%	1.36	3	0	200	<b>1.0%</b>	99.9%	<b>1.05</b>	<b>1.06</b>
22%	1.36	3	0	200	<b>5.0%</b>	99.9%	<b>1.04</b>	<b>1.05</b>
<u>7. Sensitivity to confidence level</u>								
22%	1.36	3	0	200	0.3%	<b>99.0%</b>	<b>1.10</b>	<b>1.07</b>
22%	1.36	3	0	200	0.3%	<b>99.5%</b>	<b>1.09</b>	<b>1.10</b>

Note – see also Attachment 2

Attachment 2 compares these results (which, on account of the general good agreement between simulation and analytic approximation should be regarded as one set of results, the "ISDA results"), with rather different results obtained for the case  $N = \infty$  analysed by Michael Gibson.

## Attachment 2. Results in the case $N = \infty$ (Michael Gibson's case).

The table shows the scenarios and results presented at Attachment 1, together with Michael Gibson's corresponding results in the right hand columns. The key difference is that Gibson's results are for  $N = \infty$ . Results presented are using Gibson's approximate formula (32), and to the left, results using the exact derivative with respect to covariance from (39).

Gibson's method of approximating by variances gives results that are about 2/3 of the exact asymptotic values (0.6 vs 0.9 for the "Gibson  $\alpha$ " coefficient). But the results for  $\alpha$  are much smaller than the Canabarro  $\alpha$ 's because of the omission of  $N$  as a driver, as discussed in the text.

Asset $\rho$	CE+/-	K = No factor s	G	No of cpties	PD	Conf level	Comparison to monte carlo (see Annex 1)		Comparison with Gibson: $\alpha$ with $N = \infty$ in all cases				
							Wilde Canabarro		Wilde (GA)		Gibson (Variance)		
							$\alpha$	$\alpha$	"Gibson $\alpha$ "	$\alpha$	'Gibson $\alpha$ '	$\alpha$	
Base case									[See note]		[See note]		
22%	1.36	3	0	200	0.3%	99.9%	1.26	1.09	0.90	<b>1.0073</b>	0.608	<b>1.0049</b>	
1. Sensitivity to pairwise correlation													
0%	1.36	3	0	200	0.3%	99.9%	1.53	1.43	$\infty$	$\infty$	$\infty$	$\infty$	
12%	1.36	3	0	200	0.3%	99.9%	1.37	1.21	1.32	<b>1.0106</b>	0.78	<b>1.0063</b>	
24%	1.36	3	0	200	0.3%	99.9%	1.25	1.08	0.85	<b>1.0069</b>	0.59	<b>1.0048</b>	
50%	1.36	3	0	200	0.3%	99.9%	1.12	1.02	0.42	<b>1.0034</b>	0.52	<b>1.0042</b>	
2. Sensitivity to level of current exposures													
22%	0	3	0	200	0.3%	99.9%	1.98	1.35	0.90	<b>1.1508</b>	0.61	<b>1.1014</b>	
22%	1	3	0	200	0.3%	99.9%	1.41	1.14	0.90	<b>1.0259</b>	0.61	<b>1.0174</b>	
22%	2	3	0	200	0.3%	99.9%	1.13	1.05	0.90	<b>1.0004</b>	0.61	<b>1.0003</b>	
22%	3	3	0	200	0.3%	99.9%	1.06	1.03	0.90	<b>1.0000</b>	0.61	<b>1.0000</b>	
3. Sensitivity to the number of market risk factors													
22%	1.36	1	0	200	0.3%	99.9%	1.27	1.10	0.90	<b>1.0218</b>	0.61	<b>1.0147</b>	
22%	1.36	5	0	200	0.3%	99.9%	1.26	1.08	0.90	<b>1.0044</b>	0.61	<b>1.0029</b>	
22%	1.36	10	0	200	0.3%	99.9%	1.26	1.08	0.90	<b>1.0022</b>	0.61	<b>1.0015</b>	
22%	1.36	50	0	200	0.3%	99.9%	1.26	1.08	0.90	<b>1.0004</b>	0.61	<b>1.0003</b>	
4. Sensitivity to granularity of exposures (heterogenous portfolio)													
22%	1.36	3	0.5	200	0.3%	99.9%		1.08					
22%	1.36	3	1.0	200	0.3%	99.9%		1.21					
22%	1.36	3	1.5	200	0.3%	99.9%		1.34					
22%	1.36	3	2.0	200	0.3%	99.9%		1.21					
5. Sensitivity to number of counterparties													
22%	1.36	3	0	20	0.3%	99.9%	1.38	1.26					
22%	1.36	3	0	50	0.3%	99.9%	1.33	1.22					
22%	1.36	3	0	100	0.3%	99.9%	1.29	1.10					
22%	1.36	3	0	500	0.3%	99.9%	1.24	1.04					
6. Sensitivity to probability of default													
22%	1.36	3	0	200	0.1%	99.9%	1.25	1.17	0.71	<b>1.0057</b>	0.57	<b>1.0046</b>	
22%	1.36	3	0	200	0.5%	99.9%	1.28	1.07	1.03	<b>1.0083</b>	0.63	<b>1.0051</b>	
22%	1.36	3	0	200	1.0%	99.9%	1.32	1.06	1.24	<b>1.0100</b>	0.68	<b>1.0055</b>	
22%	1.36	3	0	200	5.0%	99.9%	1.55	1.05	2.20	<b>1.0177</b>	0.88	<b>1.0071</b>	
7. Sensitivity to confidence level													
22%	1.36	3	0	200	0.3%	99.0%	1.17	1.07	0.38	<b>1.0031</b>	0.61	<b>1.0049</b>	
22%	1.36	3	0	200	0.3%	99.5%	1.20	1.10	0.53	<b>1.0043</b>	0.61	<b>1.0049</b>	

**Note: "Gibson  $\alpha$ ".** This is the coefficient defined by Gibson (definition above equation (34)) for which he uses the letter  $\alpha$ . Gibson notes that this  $\alpha$  typically lies in the range 0.6 - 0.8 (pA-4) which is borne out by the above. The quantity that we have called  $\alpha$  is more or less the Gibson  $\alpha$  times the average exposure correlation, and is equivalent to  $1 + U$  where Gibson defines  $U$  at A.29.

### Attachment 3: VBA code for the function $\alpha$ used for Attachment 1.

Values of  $\alpha$  shown in the table at Attachment 1 are obtained from the parameters using the following VBA function which implements the analysis in these notes. The input parameters are the columns of the table from left to right (except “G” which is not an input).

-----  
Function alpha(rho As Double, u As Double, K As Double, N As Double, p As Double, PC As Double) As Double

Dim x, q, b1, b2 As Double

x = Application.NormSInv(PC)

q = Application.NormSDist((Application.NormSInv(p) + rho ^ 0.5 \* x) / (1 - rho) ^ 0.5)

b1 = -0.5 \* (1 - q \* (x \* (1 - 2 \* rho) - rho ^ 0.5 \* Application.NormSInv(p)) / ((rho \* (1 - rho)) ^ 0.5 \* Application.NormDist(((Application.NormSInv(p) + rho ^ 0.5 \* x) / (1 - rho) ^ 0.5), 0, 1, 0)))

b2 = (b1 - 0.5) \* q

Dim Epos As Double

Dim Eneg As Double

Epos = u \* Application.NormSDist(u) + Application.NormDist(u, 0, 1, 0)

Eneg = Epos - u

Dim mu, VA1, VA2, VB1, VB2 As Double

mu = N / 2 \* (Epos + Eneg)

VA1 = N / 2 \* (Epos ^ 2 + Eneg ^ 2)

VA2 = -N / 2 \* (Epos ^ 2 + Eneg ^ 2)

VB1 = N / 2 \* (u ^ 2 + 1)

VB2 = VA2 + N \* (N - 1) \* Application.NormDist(u, 0, 1, 0) ^ 2 / (2 \* K)

alpha = (mu \* q + VB1 / mu \* b1 + VB2 / mu \* b2) / (mu \* q + VA1 / mu \* b1 + VA2 / mu \* b2)

End Function  
-----

#### Attachment 4. Calculation of the granularity adjustment coefficients $\beta_1$ and $\beta_2$

We are using the granularity adjustment formula for capital, equation (27)<sup>13</sup>

$$t_{99.9\%} = \mu(X_{99.9\%}) + \beta(X_{99.9\%}) \quad (\text{A1})$$

where  $\beta$  is the “granularity adjustment” (24):

$$\beta = \frac{-1}{2f_x} \frac{d}{dx} \left( \frac{f_x \sigma^2}{d\mu/dx} \right)$$

The Vasicek dependence of default probability is

$$P(X) = N\left(\frac{N^{-1}(p) + \rho^{1/2}X}{(1-\rho)^{1/2}}\right) \quad (\text{A2})$$

where  $X$  is the standard normal factor. We have to evaluate  $\beta$  in this case and for a general quadratic dependence

$$\mu(x) = \varepsilon P(X)$$

$$\sigma^2(x) = aP(X) + bP(X)^2$$

The following workings are not original – see notes at end. We have

$$\beta = \frac{-1}{2f_x} \left( \frac{d(f_x \sigma^2)/dx}{d\mu/dx} - \frac{f_x \sigma^2 d^2 \mu / dx^2}{(d\mu/dx)^2} \right) \quad (\text{A3})$$

or

$$\beta = \frac{-1}{2} \left( \frac{\sigma^2 d(\log f_x)/dx}{d\mu/dx} + \frac{d\sigma^2/dx}{d\mu/dx} - \frac{\sigma^2 d^2 \mu / dx^2}{(d\mu/dx)^2} \right) \quad (\text{A4})$$

Seeing that  $d(\log f_x(x))/dx = -x$ , this is

$$\beta = \frac{-1}{2} \left( -\frac{\sigma^2 x}{d\mu/dx} + \frac{d\sigma^2/dx}{d\mu/dx} - \frac{\sigma^2 d^2 \mu / dx^2}{(d\mu/dx)^2} \right) \quad (\text{A5})$$

Writing  $\sigma^2(x) = aP(X) + bP(X)^2$  we have a corresponding split  $\beta = a\beta_a + b\beta_b$  where

$$\beta_a = \frac{+P}{2} \left( \frac{x}{dP/dx} - \frac{1}{P} + \frac{d^2 P / dx^2}{(dP/dx)^2} \right) \quad (\text{A6})$$

and

$$\beta_b = \frac{+P}{2} \left( \frac{xP}{dP/dx} - 2 + P \frac{d^2 P / dx^2}{(dP/dx)^2} \right) = P \left( \beta_a - \frac{1}{2} \right) \quad (\text{A7})$$

On rearrangement we get

$$\beta_a = \frac{-1}{2} \left( 1 - \frac{P}{dP/dx} \left( x + \frac{d^2 P / dx^2}{dP/dx} \right) \right) \quad (\text{A8})$$

On differentiating:

$$\frac{dP_A}{dx} = \frac{\rho_A^{1/2}}{(1-\rho_A)^{1/2}} n\left(\frac{N^{-1}(p_A) + \rho_A^{1/2}x}{(1-\rho_A)^{1/2}}\right) \quad (\text{A9})$$

$$\frac{d^2 P_A}{dx^2} = -\frac{\rho_A (N^{-1}(p_A) + \rho_A^{1/2}x)}{(1-\rho_A)^{3/2}} n\left(\frac{N^{-1}(p_A) + \rho_A^{1/2}x}{(1-\rho_A)^{1/2}}\right) \quad (\text{A10})$$

<sup>13</sup> See for example, Gordy, “A risk factor model for ratings based capital rules”, Federal Reserve, October 2002, or Martin and Wilde “Unsystematic Credit Risk”, RISK, November 2002.

Hence

$$x + \frac{d^2 P_A / dx^2}{dP_A / dx} = x - \frac{\rho^{1/2}(N^{-1}(p) + \rho^{1/2}x)}{(1-\rho)} = \frac{x(1-2\rho) - \rho^{1/2}N^{-1}(p)}{(1-\rho)} \quad (\text{A11})$$

We therefore obtain finally

$$\beta_a = \frac{-1}{2} \left( 1 - N\left(\frac{N^{-1}(p) + \rho^{1/2}x}{(1-\rho)^{1/2}}\right) \frac{x(1-2\rho) - \rho^{1/2}N^{-1}(p)}{\rho^{1/2}(1-\rho)^{1/2}n((N^{-1}(p) + \rho^{1/2}x)/(1-\rho)^{1/2})} \right) \quad (\text{A12})$$

and from 4.0;

$$\beta_b = P(x) \left( \beta_a - \frac{1}{2} \right) \quad (\text{A13})$$

These are incorporated directly into the VBA code in Attachment 2.

The relation (A8) for  $\beta_a$  is from Wilde, “Probing Granularity”, RISK, August 2001 and (A13) for  $\beta_b$  in Pyhtkin and Dev “Analytic Approach to Credit Risk Modelling”, RISK, March 2002.

## Appendix C

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3 November 2003,

The International Swaps and Derivatives Association, the London Investment Banking Association and the International Association of Credit Portfolio Managers (together, the Associations) welcome the opportunity to comment on the Federal Reserve Board (FRB) White Paper on the Treatment of Double Default and Double Recovery Effects for Hedged Exposures under Pillar I of the New Basel Capital Accord (in the following, the White Paper).

The lack of account taken of double default and double recovery effects in the proposed Basel II solvency standards is a crucial concern for the Associations, and we applaud the initiative taken by the Federal Reserve Board in this regard.

As already emphasized in the Associations' responses to the Basel Committee consultation papers on the New Capital Accord, continuing to apply the so-called substitution approach is fundamentally flawed: the capital charges produced by this approach are extremely onerous and bear no resemblance to the amount of economic capital internally allocated by firms against the exposures concerned. Such is the discrepancy that firms may be discouraged from purchasing much needed credit risk protection, resulting in unsuitable risk management decisions being made. At a macro economic level, the substitution approach acts as a constraint on the development of liquidity in the credit derivatives market.

The Associations however remain convinced that the regulators see benefit in the wider availability of liquid credit risk mitigation instruments, such as credit defaults swaps, and do not wish to prevent their use by imposing inappropriate regulatory capital requirements. The White Paper is the absolute proof of the interest and appeal that such instruments present for a major regulator.

The Associations understand that the White Paper is produced in the context of the implementation of the New Capital Accord in the US. We would however strongly recommend its review by the Basel Committee, as (i) it is not anchored in specifically US market practice, and includes recommendations in our opinion valid in all jurisdictions; (ii) it would be damaging to the harmonious development of the credit derivative market if the capital treatment of these products in the US diverged from that retained in other G-10 countries.

The FRB has raised a number of concerns in the White Paper and called for industry feedback on certain issues. The Associations wish to offer input on the following topics :

- A-Scope of approach
- B-The ASRF model : principles and calibration
- C-Concentration Risk
- D-Use Test
- E-Wrong way risk
- F-Capital Arbitrage

We have undertaken a survey of market practices, appended to this letter (Appendix 1), to better inform our commentary, particularly on the calibration of the ASRF model and the use test.

### **A- Scope of approach**

All banking activity giving rise to two name risk should in principle be treated consistently for capital purposes : credit derivatives, risk participations in standby letters of credit, confirmed letters of credit, risk participations in unfunded revolving credits, rediscounted bankers' acceptances or parental guarantees are examples of instances where a bank is exposed to two name risk (see Appendix 2 for detail).

The capital treatment applied to these exposures should reflect double default and double recovery effects. These may be internalised in the rating assigned to the hedge exposure, or modelled explicitly. The regulatory requirement will depend on whether internalisation in the form of a hedged asset rating is recognised. The ASRF model proposed by the FRB is an explicit model where no account is taken of the hedge in the probability of default attributed to the underlying obligor. The Associations provide under "D-Use test" below an assessment of the prevalence of internalisation for various types of hedges.

## **B- The ASRF model : principles and calibration**

The Associations wholly support the methodology employed to produce the proposed ASRF charges. We accept that this methodology, founded on conditional joint default probabilities, is more closely aligned with the IRB function than the approach ISDA had recommended in October 2001<sup>1</sup>.

The Associations also note that, in the central scenario retained in the White Paper (Conclusion, page 31), the amount of capital relief implied by the ASRF model is, on average, higher than that achieved under our original proposal. This, ex post, serves to demonstrate the extreme conservatism of ISDA's suggested approach.

We understand, given the magnitude of the capital savings implied, the FRB's inclination for a prudent calibration of the ASRF model. The ASRF function should be parameterised in a realistic and cautious manner, avoiding excess complexity, as well as inconsistency with bank practice.

The FRB specifically invites feedback from industry on three key parameters of the ASRF formula :  $\rho_{og}$ , the specific asset return correlation between the protection provider and the underlying issuer;  $\rho_g$ , the average asset return correlation for protection providers, and the joint loss given default between the underlying obligor and the protection provider.

### 1- Parameter $\rho_{og}$ :

Of the 21 respondents to the survey, 13 employ an economic capital model where double default effects are represented in a relatively sophisticated manner. A majority of these firms set  $\rho_{og}$  equal to the base case identified in the White Paper -  $(\rho_o \times \rho_g)^{0.5}$ . 3 respondents, all of whom calibrate  $\rho_{og}$  more conservatively, were able to provide an indication of the values they would assign to it: for one of them, the parameter takes values ranging from mildly negative to maximum depending on the pair of obligors, with an average of 25%. Another firm uses a uniform 45% calibration. The last one sets  $\rho_{og}$  equal to base case plus 20%.

In seeking a suitable value for the parameter  $\rho_{og}$ , we believe it is more intuitive to consider the *conditional* correlation implied by an input value of  $\rho_{og}$ . This is the remaining correlation between obligor and guarantor conditional on a realised 99.9% worst case value of the ASRF systematic variable. As identified in the white paper, the conditional correlation is given by

$$\rho_{og}(\text{Conditional}) = \frac{\rho_{og} - \rho_o^{1/2} \rho_g^{1/2}}{(1 - \rho_o)^{1/2} (1 - \rho_g)^{1/2}}$$

This correlation can be intuitively described as the asset price correlation between obligor and guarantor due to factors connecting these entities which are not part of the general correlation between obligors implied by the single factor underlying the IRB

---

<sup>1</sup> ISDA letter to Oliver Page, Chairman of the Capital Group, on the regulatory capital treatment of hedged exposures and joint default risk, October 3, 2001.

approach. For example, in the case of two closely connected entities one could simply take :

$$\rho_{og} \text{ (Conditional)} = 1$$

which corresponds to the rather unintuitive setting

$$\rho_{og} = \rho_o^{1/2} \rho_g^{1/2} + (1 - \rho_o)^{1/2} (1 - \rho_g)^{1/2}$$

(this is strictly less than one unless  $\rho_o$  and  $\rho_g$  are the same).

**Determination of a suitable range for  $\rho_{og}$  (Conditional) is still judgmental, but we feel it corresponds slightly more closely than  $\rho_{og}$  to an intuitive picture of the situation.**

**In the absence of wrong way risk, we suggest a parameterisation :**

$$\rho_{og} \text{ (Conditional)} = 30\%$$

Giving the formula :

$$\rho_{og} = \rho_o^{1/2} \rho_g^{1/2} + 0.3(1 - \rho_o)^{1/2} (1 - \rho_g)^{1/2}$$

We note that although this looks complicated, it is the simple 30% conditional value, not the more complex unconditional correlation, that enters the ASRF model formulae and we suggest accordingly that the formulae be simply restated to refer to the conditional correlation,  $\rho_{og}$  (Conditional), rather than the unconditional value  $\rho_{og}$ . For reference, the unconditional correlations equivalent to this choice are as shown, for a range of values of  $\rho_o$  and  $\rho_g$  :

	0%	5%	10%	15%	20%	24%
0%	30%	29%	28%	28%	27%	26%
5%	29%	34%	35%	36%	36%	36%
10%	28%	35%	37%	38%	40%	40%
15%	28%	36%	38%	41%	42%	43%
20%	27%	36%	40%	42%	44%	45%
24%	26%	36%	40%	43%	45%	47%

The values of  $\rho_{og}$  indicated in the table above are generally conservative compared to those used internally by firms.

## 2- Parameter $\rho_g$ :

The Associations believe that calibrating  $\rho_g$  more conservatively than is implied by the IRB function ( $\rho_{irb}$ ) would be doubly inconsistent:

- (i) Firstly, with the correlation parameter employed to determine the credit risk capital charge applied to direct exposures to the guarantor. It appears wholly unjustified to use the IRB correlation factor ( $\rho_{irb}$ ) to derive the capital charge attributable to a loan to a counterparty, whilst applying a higher correlation factor ( $\rho_g$ ) in determining the charge applied to an exposure guaranteed by this same counterparty. The member firms we surveyed use the same correlation factor in both cases in their economic capital models. It is also worth noting that using a conservative  $\rho_g (> \rho_{irb})$  parameter has the adverse effect of producing ASRF capital charges

exceeding the substitution charge (calculated based on  $\rho_{irb}$ ), for underlying assets of poor credit quality.

The following table shows that for underlying obligors of a low credit quality, calibrating factors  $\rho_g$  and  $\rho_{og}$  at 50%, as proposed in the central scenario retained by the FRB in its conclusions, would produce capital charges exceeding the substitution charge.

COMPARISON BETWEEN SUBSTITUTION AND ASRF [ RHOOG=RHOG=50%]

Guarantor PD	Obligor PD							
	0.03%	0.10%	0.50%	1%	2%	5%	10%	50%
0.03%	-0.54%	-0.45%	-0.21%	-0.05%	0.14%	0.43%	0.68%	1.72%
0.10%	-0.46%	-1.18%	-0.63%	-0.27%	0.16%	0.87%	1.55%	4.39%
0.50%	-0.29%	-0.76%	-2.32%	-1.45%	-0.41%	1.41%	3.39%	12.47%
1%	-0.20%	-0.54%	-1.69%	-2.45%	-1.07%	1.38%	4.22%	17.86%

Highlighting marks instances where ASRF charges exceed substitution charges

This outcome would be highly counter-intuitive and questionable.

- (ii) Secondly, with the Basel Committee’s decision to not differentiate asset return correlations by industry or region. Arguably, a guarantee sought by an Asian bank from a US bank would be less correlated with the protection buyer’s portfolio than the same guarantee purchased by a US bank. Incorporating this degree of fineness in the IRB framework is impossible, however. Only by relying on firms’ own portfolio models would the regulators be able to reflect such subtle effects.

A number of survey respondents note that correlation estimates used in their economic capital models depend on industry sector, and are higher for financial institutions than for other corporates (typically, ranging between 20% and 40%). However, should the Committee wish to refine its approach in this area, it should also review the correlation parameters used for other types of exposures.

In view of the above, **the Associations caution against retaining a more conservative calibration for  $\rho_g$  than the relevant IRB asset return correlation. Where conservatism can be added to reflect a degree of “systematic” wrong way risk is in relation to parameter  $\rho_{og}$ , as suggested above.**

### 3- Joint Loss Given Default :

Respondents generally ascribe the LGD of the guarantor (ignoring recourse on the underlying obligor) or (which in practice often amounts to the same result) the minimum LGD between the obligor and the guarantor -min (LGOo,LGDg)- to a hedged exposure. The latter approach is technically equivalent to adopting a substitution approach to recovery rates. Only the most sophisticated firms seek to model joint recovery in a more accurate and less conservative fashion.

**For conservativeness and simplicity, the Associations would recommend that joint LGD be set equal to min (LGD<sub>o</sub>,LGD<sub>g</sub>) for a hedged exposure. We however would emphasise the need for regulators to review internal practices closer to the New Accord's implementation date, with a view to appraising developments in the modelling of joint recovery by firms. In particular, firms treated under the Advanced IRB approach should be able to receive recognition for their joint recovery estimates.**

### **C- Concentration risk**

#### 1- Concentration in the credit derivatives market :

We have commented on market concentration in a previous letter dated April 4<sup>th</sup>, 2003. We acknowledge that the number of protection sellers in credit derivatives markets is limited, and that a few firms are responsible for a substantial proportion of CDS trading. A report published by Fitch Ratings on March 10<sup>th</sup>, 2003<sup>2</sup> confirms that counterparty risk is concentrated among the top 10 global banks and broker dealers.

It is important to note that concentration is, among other causes, a corollary of the regulatory treatment of unfunded forms of credit risk protection. By virtue of the substitution rule, only protection acquired from sellers whose risk weight is lower than that of the underlying issuer results in capital relief. Under the current Basel framework, this has meant that only financial institutions (and in some jurisdictions, highly rated corporates) could sell protection. The New Accord will restrict the number of eligible sellers by subjecting them to a minimum rating requirement. This rating limitation is wholly out of line with firms' assessment of double default risk : a BBB rated protection seller can perfectly mitigate credit risk arising from an A rated exposure, provided that the underlying obligor and the seller are not strongly correlated in default. By recognising precisely this characteristic, the ASRF model has the potential to create new opportunities for protection sellers, and be conducive of greater diversification in future.

In addition, the impact of market concentration is mitigated by several factors:

- (i) Credit derivatives give rise to no more concentration risk than other financial derivatives<sup>3</sup>, repos, or interbank loans. Treating them more harshly than these other products is difficult to justify.
- (ii) Credit derivatives are generally documented under Master Agreements permitting the netting of exposures. The net amounts are often collateralised. These risk mitigating features, along with the high credit rating of firms active in this market, considerably reduce the magnitude of counterparty risk.
- (iii) Finally, should large exposures arise from credit derivatives positions, these would be capitalised separately by firms under the Large Exposures regimes in place in most G-10 jurisdictions.

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<sup>2</sup> Global Credit Derivatives : Risk Management or Risk ?, March 2003

<sup>3</sup> ISDA is currently surveying its Board member firms, which include the major dealers internationally, regarding (1) the extent of their derivatives credit exposure to other dealers and (2) how they manage the resulting risk.

In our view, adopting a more realistic treatment of double default risk will result in greater liquidity, and therefore encourage the entry of new participants in the credit derivatives market, leading to increased diversification.

## 2- Concentration risk under the New Accord :

Credit default swaps can be, and are often used to reduce credit risk concentration in banks' books. Because concentration risk is not captured under Pillar 1 of the proposed New Accord, regulators purely and simply ignore the full extent of hedging achieved via CDSs where setting a firm's minimum capital requirement. The ASRF model is insensitive to concentration risk, and hence, does not encourage firms to "disproportionately" increase their use of credit risk mitigants.

ISDA acknowledges the existence of concentration risk. We have tended to view Pillar 2 as a more appropriate vessel for addressing supervisory concerns arising from the lumpiness of portfolios, because regulators have refused to rely on firms' own assessment of granularity under Pillar 1. We hope that in future, the Committee will consider the benefits of placing more reliance on firms' internal credit portfolio modelling, which would result in concentration risk impacting minimum capital requirements. Meanwhile, the ASRF model offers a suitable and reasonable way forward.

It is also implied in the White Paper that firms may substitute concentrated exposures to borrowers with equally concentrated exposures to protection sellers. For reasons detailed above, we view this concern as generally questionable.

## **D- Use test :**

The Associations have sought to assess the impact of double default on the pricing of hedges, as well as on the risk management of hedged exposures.

### 1- Market prices :

Survey respondents concur in finding no relationship between the market price of single name CDSs and the degree of default correlation between the underlying obligor and the protection seller. Indeed, CDS prices show little sensitivity even to the credit quality of the seller, which respondents attribute to the high creditworthiness of dealers in the CDS market. Four firms mention collateralisation as being a cause for lack of price sensitivity. A minority of respondents note that adjustments may be made by the trading desk on an ad hoc basis depending on the specifics of the transaction.

On the contrary, the pricing of basket CDSs takes account of correlation between the seller of protection and the assets in the basket. Similarly, firms comment that in the case of financial guarantees (including risk participations and standby letters of credit), spread or fees charged would normally be reflective of double default effects.

Several firms believe that ultimately even vanilla CDS prices will reflect double default and double recovery effects. A number of factors will contribute to this outcome: (i) more market participants, representing a broader range of credit quality ;

(ii) a more liquid market, where differences in pricing of the underlying risk may not obscure counterparty risk adjustments any more; (iii) better quality and more easily available information (PD, LGD and correlation); (iv) the further development of quantitative modelling approaches.

## 2- Risk management :

### *(i) Impact of double default on ratings :*

A majority of survey respondents reflect the existence of CDS protection in the LGD or EAD assigned to the underlying obligor. In contrast, firms would normally alter the rating (or PD) of the exposure where a parental guarantee was provided (typically by substituting the rating/PD of the parent for that of the subsidiary if the former was higher). A majority would also reflect third party guarantees negotiated at inception in the rating/PD assigned to the underlying exposure.

**Where a rating or joint PD is assigned to a hedged exposure, the Associations would advocate recognition of this rating/PD by the regulators.** A parallel can be drawn here with the treatment of securitisation tranches, where the degree of correlation in the portfolio collateralising the tranches is acknowledged indirectly, via reliance on the tranches' external rating. **If ratings cannot be recognised, then an explicit model of two-name risk must be used to reflect double default/recovery effects.**

### *(ii) Impact of double default on credit limits :*

Respondents, with one exception, do not reflect double default effects in the credit limit assigned against the underlying obligor : they view the underlying position as hedged (taking due account of basis risk) and the size of the hedge is calculated without taking account of double default.

One firm accounts for the impact of double default in setting limits on trading book positions hedged by CDSs.

### *(iii) Impact of double default on banking book economic capital :*

Six firms totally ignore double default effects within their economic capital model or do not have an economic capital model.

Two respondents use a crude approach, whereby wrong way risk results in the substitution approach being used, and the absence thereof in full credit risk offset.

For the remaining 13 respondents, the economic capital treatment of a hedged exposure depends on whether the hedge impacts on the rating/PD of the obligor.

If so, double default correlation influences economic capital only through its effect on the rating/PD (only one firm systematically reflects double default in the rating of the exposure, including where it is hedged by credit derivatives), assigned to the hedged exposure.

If not, respondents adopt one of the two following approaches :

- 7 firms treat hedged exposures as offset in the banking book, taking due account of any existing basis risk (owing for instance to maturity mismatches or recovery rate discrepancies between bonds and loans). Double default risk solely impacts the evaluation of the firm's exposure to the seller of protection, as well as the economic capital assigned against this exposure.
- The other firms assign capital against double default risk in the banking book.

The joint occurrence of default between obligors in the portfolio (see B.2. above for greater detail) is usually modelled based upon equity return correlations, often approximated by using factor models (reflecting the industry and place of business of the obligors, as well as exposure size). Spread correlation is used by a few firms.

**In summary, double default effects have an impact on a majority of the respondents' economic capital calculations. Substitution is not the approach of choice.**

### **E- Wrong way risk**

Of the 21 respondents, 4 do not recognise or explicitly capitalise wrong way risk. The rest have internal policies in place outlining possible causes for such risk.

Three firms specifically forbid buying protection from related counterparties; the others simply outline where a substitution approach to risk is adequate. Discriminating criteria are legal [existence of a legal connection or control between the obligors] and economic [e.g. : same place of business].

Firms increasingly consider wrong way risk as one particular state on the continuum of pairwise default correlations and ensure that the appropriate correlation/rating is fed into the economic capital model they use, or that excess risk is mitigated (e.g. through collateralisation).

### **F- Capital arbitrage**

Under the New Accord, we understand that regulators will only recognise banking book hedges booked in the trading book if the resulting trading book positions are themselves hedged by a third party (paragraph 664 of CP3).

In this context, we would question the grounds upon which the White Paper implies that arbitrage would occur in the trading book. It should be possible for a firm to hedge a banking book exposure in accordance with paragraph 664 mentioned above, whilst actively trading credit risk on the same name in the trading book. Traded credit risk arises over a much shorter period of time, and includes a much larger spread risk component, than banking book credit risk. For this reason, ISDA views the differential treatment of credit risk in both books as justified. Ideally of course, it should be possible to treat credit risk along a continuum, ensuring that the same model was used across the banking/trading book boundary, and varying the key parameters (time horizon, migration risk, pure spread volatility risk). This would

however require that valuation principles in the banking book change to reflect fair valuing, which we do not think is achievable in the short term.

## APPENDIX ONE

### Fed White Paper on Double Default and Double Recovery

#### **Questionnaire to ISDA-LIBA-IACPM member firms**

The Federal Reserve Board (FRB) identifies a number of issues in a recent research paper on the Treatment of Double Default and Double Recovery Effects for Hedged Exposures [June 2003]. One specific concern, which the following questionnaire is intended to address, is whether firms reflect double default and double recovery effects in the risk management and pricing methodologies applied to credit default swaps. The FRB also queries the recognition by firms of wrong way risk (arising where risks to the reference obligor are highly correlated with those to the protection buyer).

Regulators as a general rule seek to avoid anticipating on market practice, and would hesitate to reform the capital treatment of hedged exposures if it appeared that firms did not internally take account of double default/recovery effects and wrong way risk.

The following questionnaire is intended to allow ISDA to form a view on firms' practice. Responses will be kept in the strictest confidentiality.

*We would be grateful if respondents could provide as much detail as possible in their answers to the following questions.*

#### A- PRICING OF CREDIT DEFAULT SWAPS :

- (i) Do double default effects impact on the pricing of credit default swaps? Please explain how.
- (ii) Do double recovery effects impact on the pricing of credit default swaps? Please explain how.

Respondents should provide a brief description of their CDS pricing model.

#### B-RISK MANAGEMENT OF CREDIT DEFAULT SWAPS :

How do double default and double recovery effects impact on (i) the credit rating assigned to a hedged exposure ? (ii) the credit limits imposed on the protection provider ? the underlying issuer ? (iii) the economic capital allocated against the hedged exposure ?

- (i) Credit rating :

Please specify which component of the rating (probability of default, loss given default) is influenced by which effect (double default, double recovery), as well as which measure of risk the rating itself is based upon [e.g., for facility ratings : expected loss or economic capital]. Also detail how each of the components of the rating would be modified by the existence of a CDS hedge.

(ii) Limits and economic capital :

Please indicate if double default and recovery effects impact on credit limits/economic capital in a manner distinct from their influence on credit ratings. If so, please provide detail.

In particular, does your firm use an asset return correlation parameter for the guarantor/protection provider [factor  $\rho_g$  in the Fed research paper], which is distinct from that assigned to a direct exposure [e.g. loan] to the guarantor ?

In your economic capital model, are financial institutions' asset returns more correlated with your portfolio than the average corporate's ?

Does your firm assess the degree of specific asset return correlation between the guarantor/protection provider and the underlying asset issuer [factor  $\rho_{og}$  in the Fed paper] ? Do you find that your estimate for  $\rho_{og}$  is distinct from the base case identified in the Fed paper [ $(\rho_o \times \rho_g)^{0.5}$ ] ? If yes, is it substantially higher ? What would be the worst value used by your firm for  $\rho_{og}$  ? When would it apply

(iii) Wrong way exposures :

Does your firm differentiate between wrong way exposures (in the context of credit derivatives, hedged exposures where the value of the exposure is positively correlated with the likelihood of default of the protection provider; e.g. instances where the protection provider is legally connected with the underlying issuer) and other exposures ? How is the distinction operated ? What are the distinguishing criteria used ? Are they codified ?

## APPENDIX TWO

**To:** Norah Barger  
Federal Reserve Bank of New York

**From:** Philip Chamberlain, Portfolio Management Division, The Bank of New York

**Subject:** Scope of Guarantees Relevant to Basel II

**Date:** September 26, 2003

In discussion of the Fed's double-default paper with Emmanuelle Sebton of ISDA some time ago, I mentioned that the scope of double-default in bank portfolios (a.k.a. two-name paper) is far broader than the credit derivative book. She asked me to specify some corners of the traditional book where third-party guarantees would likely be subject to the same analysis as a credit default swap or similar instrument. Four instances came quickly to mind. In each class of transactions, the pricing of the transaction necessarily reflects double default risk analysis, as you will see. It may be that an examination of one or more of them might address the concern expressed on page 31 of the double default paper, that "the staff has been unable to quantify pecuniary effects from double default and double recovery effects."

**1. Risk participations in standby letters of credit.** A "fronting" bank opens a large standby letter of credit in behalf of a bank group. Generally one bank does this, so that commercial paper or bond investors who rely on the letter of credit will see a single, easily recognized name in the market. The bank then sells risk participations to all the other banks in the bank group; the other banks fully accept their pro rate share of the credit risk in the letter of credit, but of course fund nothing at the outset. In the case of a draw on the letter of credit, the fronting bank calls on all the participants to fund their portions to reimburse the fronting bank.

The fronting bank is responsible for funding the letter of credit whether or not the participants send in their reimbursement. Therefore, the fronting bank has two-name paper with respect to all the participated portion of the L/C, which could easily be 90% of the entire credit. If the ultimate credit and the participating bank should both default (one on the reimbursement agreement, the other on the participation agreement) the fronting bank faces a credit loss.

There is considerable volume in this structure, some of it at typical term loan maturities, with most of the highly rated international banks taking part as fronting banks in behalf of prominent customers.

**The pecuniary effect would be discerned here between the "fronting fee" charged in these transactions and the credit spread for similar unsecured extension of credit to the participating bank.**

**2. Confirmed letters of credit.** In this credit classic, a bank well known to the beneficiary of a letter of credit confirms a letter of credit issued by (generally) a bank in another country well known to the party opening the letter of credit. The confirming bank (we are a confirming bank in a number of instances) accepts credit exposure to the ultimate credit and to the original letter of credit bank. To suffer a loss, both the ultimate credit and the letter of credit bank must default on their

obligations, which are absolute under law. (The only other risk is of faulty documentation, which is an issue properly reserved for operational risk.)

**The pecuniary effect would be discerned here between the “confirmation fee” charged to confirm these letters of credit and the credit spread for similar unsecured extension of credit to the bank that opened the letter of credit.**

3. **Risk participations in unfunded revolving credits.** We regularly sell to other banks risk participations in unfunded revolving credit agreements with customers. The risk participant bank is not a member of the credit agreement bank group, but takes some of the risk and reward by participating in our commitment to the credit agreement. We as participating bank must fund the revolving credit if called upon, and then claim reimbursement from the participant under the participation agreement. We as participating bank have double-default exposure to all the participated risk. If the participant bank and the underlying credit both default, the participating bank has a credit loss, otherwise not.

**The pecuniary effect would be discerned here between the primary lender’s retention of a portion or either fees or loan spread and the credit spread for similar unsecured extension of credit to the bank participant. The transaction’s terms may in this case be affected by the terms of other business transacted between the same two banks.**

4. **Rediscounted bankers’ acceptances.** The original holder of a note essentially sells the note at a discount to the note maker’s bank. The bank then rediscounts the note to money market investors, who have both the bank and the original note maker as obligated to pay. (This technique is centuries old, I believe, and does not by tradition provide full documentation to the money market investor of the character of the underlying note. The two-name paper characteristic is undeniable, however, and the rates available to such paper are worth examining.)

**The pecuniary effect would be discerned here between the average credit spread on the rediscounted BA and the credit spread for comparable maturity negotiable certificates of deposit issued by the same bank.**

A final observation regarding the double default paper’s concern about measuring direct pecuniary effects to justify double default’s importance. We need to remind ourselves that the effect of double default on pricing, compared with pricing for the stronger of the two borrowers, is **always likely to be real but small**. It makes an already narrow credit spread a trifle narrower. That means that double default has only a mild effect on expected loss.

By contrast, double default should have a large impact on capital, because it sharply reduces the likelihood of the outlier default event. Double-default is a refinement to expected loss; it is a major contributor to an economic capital calculation.

## Appendix D

# ISDA's comments on Section 2.V of CP3- Operational risk

### Scope of comments

ISDA's main comments regarding the rules on operational risk focus on the Advanced Measurement Approach (AMA), which is a major focus of industry development effort.

We note, however, the following points with regards to the overall framework for operational risk.

### Operational risk framework

First, the incentives to progress to the AMA are still not clear or proven, particularly if financial groups were to face the management burden of each legal entity having to qualify for the AMA. (We discuss this issue further below – see “AMA Issues”, section “2”.) Moreover, for some types of firm, there will also be a systematic *dis*-incentive to move to the Standardised Approach, given that the beta factors for some business lines are higher than the alpha factor agreed for the Basic Indicator Approach. Equally, this level of beta means that some firms will feel a greater pressure to move to the AMA than others. Fundamentally, in presuming that firms generally ought to be on the AMA, the Accord has gradually but inexorably moved away from an earlier consensus point that firms should be free to adopt the approach that provides the most cost-effective means of risk management and to move to a more advanced method only when this delivers clear risk-management benefits for the firm. We consider this nexus of structural issues to constitute a weakness in the Accord.

Also with regard to the role of the AMA, it is publicly acknowledged that, in spite of considerable joint work by industry and supervisors since the time of the first consultation in 1999, the advanced-level rules for operational risk remain much less prescriptive than those covering credit or market risks. To a significant extent, this is inevitable and, given the need to structure a framework that truly reflects the diversity of current and evolving risk management practice, welcome. The net result, however, is that, in the field of operational risk more than in any other area of the Accord, the impact of the rules will depend on issues of implementation, particularly as regards the AMA. To a significant extent, these issues will inevitably be a matter for discussion between individual firms and their supervisors, as a fuller understanding of AMA practice develops. In these circumstances, the effectiveness of the Accord will depend on a credible, explicit commitment to international co-ordination of supervisory application of the operational risk rules, combined with transparency standards regarding AMA approval. ISDA considers such a formal commitment to be a necessary integral part of the rules.

We believe it is essential more generally to provide a clear commitment to revise any elements of the operational-risk rules that may prove sub-optimal, as experience of the framework and techniques for operational risk management develop.

### AMA Issues

Overall, ISDA welcomes the continued progress on important issues and believes that further dialogue will help ensure the effectiveness of the regime for operational risk. We attach our earlier letter to the RMG by way of background discussion on the issues within the AMA on which our members have focused, namely:

1. General
2. Consolidation/Allocation
3. Correlation
4. Risk Mitigation
5. Soundness Standard

## **1. General**

ISDA fully expects further evolution of methods for managing and estimating operational risk (with the strong likelihood of more creativity on the part of firms as and when more immediate compliance deadlines linked to the introduction of the new rules have passed). ISDA believes that the Risk Management Group conference on ‘Leading edge issues in measurement of operational risk’ in May 2003 demonstrated not only common ground between the main categories of approach but also a significant degree of diversity as to how techniques within an individual firm’s overall approach may be combined and how the relative emphasis of such techniques may legitimately vary, over time as well as from firm to firm.

The current draft rules focus on four key elements of an advanced approach to operational risk: internal data, external data, scenario analysis and environment/control factors. Firms “must” use each of these (or satisfy equivalently worded constraints). ISDA believes that this sort of formulation places too much emphasis on the means, rather than the end objective, when (i) further new techniques may yet evolve and (ii) where, as stated above, there should properly be flexibility about the ways in which firms “use” techniques, including their relative emphasis.

We stress that we do not oppose the naming of these techniques in the rules. We see potential value in all of them and believe that is quite right that firms be expected to demonstrate to their supervisors a thoroughly considered evaluation of each of them and the information they yield. We simply discount any suggestion that they can be the subject of a fixed standard.

Specifically on “business environment and internal control factors” (paragraph 636), we note that what are commonly referred to as “Key risk indicators” are not generally viewed as a purely quantitative tool, if at all, and that the rules should avoid associating them with a “risk *measurement* framework” [ISDA’s emphasis].

More generally, ISDA believes that a key objective in implementing the AMA rules will be to avoid unwarranted volatility in individual firms’ capital requirements and that the AMA must accordingly be policed in a manner consistent with this objective. Rules that may be interpreted in a rigid way could only increase the chance of such volatility.

Taking all these considerations into account, we strongly suggest that the Risk Management Group revise the language along the lines that, in order to demonstrate compliance with AMA, firms should undertake a considered evaluation of the applicability of these four elements, and any others the firm considers relevant.

## **2. Consolidation/Allocation**

ISDA continues to advocate the principle of regulatory acceptance of firms’ allocation by jurisdiction of capital amounts calculated at group level. As outlined in our letter of May 20<sup>th</sup>, ISDA believes that this will be essential if the AMA is to be practicable.

The Risk Management Group has asked for more specific suggestions as to how such allocations could be determined and ISDA believes that:

- 1) distinct solutions developed by individual firms are likely to be developed and should be eligible for consideration;
- 2) in the meantime, a feasible and, crucially, verifiable solution exists in the form of gross income.

As and when other potential means of allocating capital are developed, it should be possible for firms to have these considered by their supervisors. In the meantime, ISDA members believe that there is greater risk-management benefit in focusing resources on the fundamental issue of determining, on a group-wide basis, an appropriate aggregate capital requirement.

It should, however, be noted that using gross income as the basis of allocation would not, for example, preclude the simultaneous use of key risk indicators and management judgement in identifying relative strengths or weaknesses in control among group entities, and that these other techniques could for example be used as an overlay or complement to the use of gross income. With any mechanism[s] of allocation, the key issue in allowing their use would be that their effectiveness in apportioning risk capital was periodically reviewed by the individual firm.

ISDA recognises that there will need to be a dialogue involving host-country supervisors in the case of systemically significant institutions. Home-country lead supervision should, however, remain the norm. This point is addressed in more detail in our letter of 20<sup>th</sup> May.

### **3. Correlation**

Regarding correlation, ISDA warmly welcomes the progress made in adapting the requirements to the realities of operational risk management. What seems inconsistent with this, however, is the reference to correlation in paragraph 635 of the draft rules, relating to scenario analysis.

As with the issue of “correlation” more generally, we continue to believe that the term “dependency” more appropriately reflects the range of issues at stake here. The underlying issues appear to be the potential for multiple events arising from a common cause or the co-occurrence of multiple events from distinct causes. The application of a “variance-covariance” approach to this set of issues is unlikely to yield risk-management benefit.

We take this opportunity to stress our belief that, consistent with our points above on allocation, it is appropriate for supervisors to recognise “implicit” correlations captured in group-wide AMAs, subject to reasonable checks on the credibility of such estimations.

### **4. Risk Mitigation**

The limited recognition of risk mitigation, both within the AMA and across the range of operational risk approaches, constitutes a shortcoming that ISDA believes will need to be rectified. ISDA fully supports the development of appropriate criteria to ensure that risk mitigation is effective, but believes that this combined with supervisory review should be sufficient to allow proper recognition of a potentially useful technique, of benefit to individual firms and to the system as a whole.

In particular, ISDA believes there is a policy advantage to be gained in keeping the door open to alternatives to insurance, which could include capital-market structures that provide funded protection to firms, thereby overcoming potential concerns about speed of payment. It questions the policy advantage in excluding such techniques.

### **5. Soundness Standard**

It seems to us highly likely that, simply by dint of being specifically mentioned, the 99.9% confidence level will, at some stage, become a “hard” standard, at least in some jurisdictions. In an environment where various types of AMA are contemplated as potentially meeting regulatory standards, this would clearly be inappropriate.

As with the AMA overall (see “1” above), we therefore believe that it would better reflect the apparent intention with regards to the soundness standard to stress the end-objective (soundness) rather than the means (99.9%). We appreciate that the RMG has already made helpful changes in this regard and offer this suggestion as something we believe to be the logical extension of that development. Specifically, we recommend to the RMG greater reliance on the language in paragraph 622 of the draft Accord, that requires of firms a standard that is “credible and appropriate” in estimating capital for operational risk.

On a related point, while it is right that a firm should be expected to collect data on material losses it seems to ISDA more appropriate that the exact threshold be a matter for the firm to determine and, as necessary, justify.

## **Conclusion**

In the above, ISDA has focused on those specific areas where it believes the latest draft of the Accord can be improved. Clearly, much progress has been made, particularly as compared with the first stages of the consultation, in 1999. ISDA believes that the single biggest advance has been to explicitly recognise the need for a significant degree of flexibility to be built into the rules. Our view is that much will still depend on two, inter-related factors that should be recognised explicitly in the Accord:

Implementation, as mentioned above, requiring a formal co-ordination policy among supervisors;  
Revision of the Accord’s operational risk framework, based on review of its overall effectiveness within 2 years of implementation.

As mentioned in the section on consolidation/allocation, the presumption that lead supervision will generally fall to the home country will be a pragmatic measure that we believe will aid implementation.

ISDA thanks the Basel Committee for the opportunity to comment on this important aspect of the capital framework.

# ISDA

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## **by email**

May 20<sup>th</sup> 2003

Roger Cole  
Chairman, Risk Management Group  
c/o BIS

Dear Roger,

Looking ahead to ISDA's planned meeting with the Risk Management Group in New York on May 28<sup>th</sup>, we thought it would be helpful to outline some of the key issues that member firms would prefer to discuss, and to briefly explain their position on these issues. In doing this, we have as much as possible framed issues with reference to the Basel Committee's third Consultative Paper, "CP3".

In meeting with the RMG, ISDA would welcome a focus of discussion on four main areas:

- 1) Consolidation/Allocation**
- 2) Correlation**
- 3) Risk Mitigation**
- 4) Soundness Standard**

We also include some additional points, on the credit-operational risk boundary, KRIs, and the Standardised Approach.

Overall, ISDA welcomes the continued progress on important issues and believes that further dialogue will help ensure the effectiveness of the regime for operational risk. Our comments below focus exclusively on issues where we believe further discussion is merited.

The RMG will note that a theme, apparent in our comments on both the soundness standard and the Standardised Approach betas, is the insufficient incentive to make the investments necessary to progress along the continuum of approaches outlined.

Looking ahead to implementation, and given the investments required, ISDA would appreciate assurance from RMG members that, subject to reasonable checks, firms should have a realistic prospect of moving promptly onto the AMA.

## **1. Consolidation/Allocation**

ISDA is convinced that the AMA will simply not be practical without the ability to calculate capital requirements at group level and allocate (downwards), per jurisdiction.

Key factors restricting the ability to calculate individual AMA requirements for multiple entities within a group are as follows:

- Data insufficiency at the level of individual entities (or, for that matter, groups of entities) will be particularly acute, given that this will be an issue even at group level.
- To the extent that there is a failure to recognise the significant levels of risk-diversification that firms achieve, excessive capital will result, since the sum of the individual-entity capital requirements is likely to total considerably more than the group requirement. (In connection with this, please see our discussion below on correlation.)
- There would be a major and, in a group context, duplicative management burden, if each entity (or group of entities) was required to meet AMA standards in full.

ISDA believes that the practical solution to this dilemma is to accept that firms calculate capital at group level and allocate per jurisdiction. This provides an appropriate basis for discussion with national supervisors, given their responsibilities to ensure capital adequacy in relation to entities (or groupings of entities) incorporated in their jurisdictions. Yet it remains workable for firms.

Any insistence on full AMA calculations at subsidiary level may, especially for the reasons outlined above relating to lack of recognition of diversification, tend to increase the incentive for firms to move towards a branch structure. This would not necessarily be beneficial for the system overall.

Naturally, a firm's allocation methods must be systematic, transparent and accessible to all directly interested supervisors. As with other issues, in assessing the adequacy of allocation methods, the most practical arrangement will be for the firm's home-country supervisor to lead. This will minimise duplication of effort and maximise co-ordination of review.

## **2. Correlation**

ISDA members welcome the amendments made in CP3 to the language on the treatment of correlation under the AMA. In order to help create an environment in which firms can develop a true representation of risk levels, we believe it essential that the Accord avoid any language that has the effect (whether intended or not) of prescribing a single, rigid mechanism for determining dependencies.

This is especially important because firms may not necessarily divide their business up so as to generate separate loss distributions requiring aggregation. It is entirely consistent with the management of operational risk to assess risk at a firm-wide level. ISDA opposes any requirement, explicit or implicit, to calculate risk numbers for many distinct entities (and/or risk types, and/or products) and sum them. It believes that such a procedure would systematically inflate a firm's capital requirement and inevitably, therefore, act as a *dis*-incentive to granularity in risk calculations.

Where separate loss distributions are generated, for statistical reasons a simple correlation coefficient is unlikely to be available or appropriate. (Essentially, this is due to the non-normal nature of operational risk distributions.) Outside an LDA (for instance, in predominantly scorecard approaches), a strict statistical approach to correlation may be simply irrelevant.

For these reasons, ISDA prefers the broader term 'dependency'. In ISDA's view, the approach to correlation ought to be consistent with the AMA more broadly, that is, a variety of possible approaches should be accommodated.<sup>13</sup> It is preferable for the development of the discipline of

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<sup>13</sup> Any of a number of statistical or non-statistical techniques might potentially be of value in relation to AMA approaches in estimating the likelihood of certain events occurring a) simultaneously or b) as a result of each other; eg, Common Shock, Factor Analysis, Copulas and Correlation. The terms 'dependency' and 'dependency analysis' are offered as a generic term covering the range of such techniques.

operational risk management within the AMA that firms justify a number that they themselves have estimated, rather relying on a crude and conservative assumption of ‘1’.

CP3 seems to reflect an understanding between the policy specialists amongst both regulators and firms about what is intended by ‘correlation’. But, as the framework is implemented, there is a concern that ‘correlation’ may be limited to its mathematical interpretation. In ISDA’s view, therefore, in addition to the introduction of the term ‘dependency’, further amendments are required to limit this risk, specifically with regards to the language referring to “validation” and to a “high degree of confidence”. Both of these terms tend to suppose a particular, statistical approach.

### **3. Risk Mitigation**

ISDA notes and appreciates the RMG’s continued willingness to work on this issue in support of recognising insurance, including the development of clear and fair standards against which the acceptability of a given insurance policy may be tested. Recognition of risk mitigation helps the new capital Accord to be a) risk-sensitive and b) forward-looking, which must surely be significant advantages in ensuring that it has long lasting relevance.

In this context, ISDA believes the following points are crucial:

- Within the AMA, limiting recognition to 20% of gross exposure, on top of limiting recognition to AMA firms, reduces the incentive for insurance firms to develop products that meet particular requirements.
- A cap on aggregate recognition duplicates the effect of the haircuts proposed for individual contracts.
- CP 3 states that insurance is to be provided by a third party. We recommend a change in the wording, such that the capital held in insurance captives is also recognised.
- There appears to be no reason to rule out review and potential change, as applicable to other figures in the draft Accord.
- It is ISDA’s understanding that, as and when capital market instruments emerge with risk-transfer features similar to insurance (and which could include funded protection), they can be discussed with national regulators.

We note that the limitations on recognition of insurance may well persuade a bank to ‘self-insure’ against certain risks, by treating the risk as an expected loss (which may, in principle, be excluded from the regulatory capital requirement). The apparently unintended consequence of this is to limit the protection in fact afforded in the rare instance of there being a larger-than-usual loss.

### **4. Soundness Standard**

ISDA believes that the approach to the soundness standard is helpful to the extent that it accommodates practical considerations around estimating susceptibility to operational loss. However, members continue to have concerns about this issue, at a conceptual level.

A 99.9% event is, in the context of a one-year time horizon, a) extreme (as it may be thought of as “1-in-1000 years”) and b) will inevitably entail a chronic lack of data. We stress that this is not purely a temporary problem. It is true that, for some types of operational risk event, this problem may be, or become, less acute. For such risks, for reasons of internal risk management, firms may well wish to model to this high standard. But the nature of other operational risk events – which can be of very low frequency and unrepresentative of future exposures – means that, overall, the

standard is not practical, since for these types of risk it may never be feasible or meaningful to model to this level.

We note that this appears to be implicitly acknowledged in the inclusion of techniques other than loss data modelling (especially scenario analysis) as required elements for an AMA. We should not forget, either, that a lack of data may be a positive sign, indicating an absence of loss events, rather than simply a lack of records.

ISDA acknowledges that the language associated with the soundness standard already appears to offer some flexibility. However, in order to give the right emphasis, ISDA suggests that the final Accord rules should invoke a “credible and appropriate” standard (as per paragraph 622 of CP3), making the reference to 99.9% and a one-year horizon at most a footnote.

Paragraph 64 of the ‘Overview’ paper attached to CP3 refers to “enhanced opportunities for the industry to assist in the development of proposals for aligning regulatory capital requirements with sound industry practice”. ISDA believes that the soundness standard is an issue where continuing discussion on alignment will be fruitful.

### **Further Points**

#### Credit-Operational Risk Boundary

ISDA would appreciate greater certainty regarding paragraph 633 of the draft Accord and particularly the limits on requirements to capture “operational risk” embedded in credit or market losses. ISDA accepts that tracking operational events in the credit area is indeed a good practice, but that a) mandating it as a regulatory requirement is excessive and b) even when it is presented as a good practice, it requires the enunciation of a clearer standard.

While the example quoted in paragraph 633 (collateral management failures) is instructive, the border line is not as clear as it should be. Consider, for example, a loan to a company that turns out to fail for reasons of fraud but where the loan itself is not fraudulent. Assuming this would not be required to be included in an operational loss database, it is not clear (from paragraph 633) by what criterion this is so.

We note, also, that it would be burdensome for firms to have to capture losses twice, through two, essentially duplicative processes (one for credit risk management and one for operational risk), when some losses may not necessarily merit inclusion in an operational loss database.

#### Key Risk Indicators

In addition to the above issues, the ISDA Operational Risk Working Group has been discussing a range of implementation issues. It considers it timely to note that there are a number of points in relation to the use of control factors/Key Risk Indicators that will be worth clarifying, in the light of the rules as they currently stand. It would welcome RMG comment on the value of such work (some but not all of which might admittedly be primarily of relevance in national discussions), whether within the time frame of the current consultation or over the longer term.

#### Standardised Approach

ISDA continues to believe that it introduces insufficient incentive to move to the SA to have any beta factors higher than the alpha factor that applies under the Basic Indicator Approach.

## Conclusion

In conclusion, ISDA welcomes the continued progress towards a workable regulatory capital regime for operational risk within the context of a revised Accord. We especially appreciate the flexibility shown on partial use of AMA.

Overall, however, ISDA believes that, in order to be truly effective, the rules should also take into account the issues highlighted here; and welcomes the opportunity to discuss these more fully with the RMG, in New York and during the remainder of the consultation period.

Yours sincerely,

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