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Industry Technical Paper on Incremental Default Risk

The following paper was prepared for the International Swaps and Derivatives Association (ISDA), the Institute of International Finance (IIF) and the London Investment Banking Association (LIBA) by a Technical Working Group.

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Table of Contents

1.	Introduction.....	1
2.	Principles.....	2
2.1	Confidence Level.....	2
2.2	Capital Horizon.....	2
2.3	Aggregation with Existing Market Risk Charge.....	3
2.3.1	Single name concentration risk.....	4
2.3.2	Other diversifications between market and systematic credit risk.....	4
2.3.3	Summary on aggregation.....	5
3.	Modelling Details.....	6
3.1	Constant Level of Risk.....	6
3.2	Liquidity Horizon.....	6
3.3	Short Horizon Probability of Default.....	7
3.4	Loss Given Default.....	8
3.5	Recognition of Offsets.....	8
4.	Appendix – Example Calculations of Correlation between VaR and IDR.....	9
4.1	Perfect correlation between Market losses and systemic Credit risk.....	9
4.2	Imperfect Correlation between Market losses and systemic Credit risk.....	11

1. Introduction

Regulators have repeatedly expressed concern at increasing levels of default risk in banks' trading books, and have asked that banks hold regulatory capital to protect against this risk in the form of an Incremental Default Risk Charge (IDRC). In particular, concern has been expressed at concentration of exposures and the possibility of achieving capital savings by moving assets from the Banking Book to the Trading Book.

The industry recognises these concerns, and is happy to work with regulators to design an approach which captures these risks. However, we believe that some of the proposals made by regulators would lead to an IDRC which does not accurately reflect the default risk in a traded portfolio, is not risk sensitive, and is not aligned with banks internal risk management processes. We outline below what we consider to be the key points and, where we disagree with regulatory proposals, present what we regard as a better alternative.

Simple examples of modelling have been used to support some of the recommendations included in the paper. These are for illustrative purposes only; the Technical Group does not advocate the adoption of any particular model.

2. Principles

2.1 Confidence Level

The technical group agrees with regulators that portfolio credit risk can be captured only by direct estimation of the tails of the loss distribution, rather than by ‘scaling up’ from a less extreme scenario. This could be done by computing Value-at-Risk at a confidence level of 99.9%, or alternatively by computing Expected Shortfall at an appropriate confidence level (see footnote 4 in Appendix 4.1).

2.2 Capital Horizon

The AIGTB WG draft Principles (Principle A) state that a capital horizon of one year should be used to compute the IDRC. The technical group argues that given the dynamics of capital management with respect to trading book activity a 1-year capital horizon is inappropriate. The assumption of a “constant level of risk” used to generate the capital horizon requirement should take into account a realistic interpretation of the capital management processes that a bank uses for the trading book. This should reflect the impact of the shorter liquidity horizon, which allows a more dynamic process of capital review and allocation than is the case for the banking book.

In the event of a significant market stress, a bank will determine its trading losses over the period of its liquidity horizon. Based upon this information, the bank will review its strategic involvement in the relevant trading book activity. The choices are:

- a) Close down involvement in the activity
- b) Continue the activity but take less principal risk (ie: increase hedging activity or amend the business model to focus on satisfying client flow with less principal risk)
- c) Continue the activity with similar levels of risk to those taken prior to the stress event

If options (a) or (b) are undertaken, then the bank no longer needs to hold those levels of capital that were held before the stress loss. A capital horizon of 1 year is therefore inappropriate, as further stress events will not have the same impact on the bank’s P&L and do not need to be supported by further capital.

If option (c) is undertaken, then additional capital is required to restore the bank to the levels deemed appropriate before the stress event occurred. However, the industry group argues that in this event, the institution would in fact raise additional capital to undertake the activity. If the institution were unable to raise this capital, then it would revert to options (a) or (b). If the institution is able to raise the capital, then it is inappropriate to require that it holds it in advance, as would be required by a 1-year capital horizon.

The level of principal risk taken in trading book activity is in the significant majority of cases amendable at the bank’s discretion in a far shorter time period than 1 year. It is therefore inappropriate to require a capital horizon of 1 year as the management of a bank’s balance sheet with respect to trading book activity is much more dynamic than this horizon implies.

We argue that the capital horizon should reflect the timescales of the typical bank's capital management process with respect to wholesale financial market activity. This involves executive governance and decision taking at least monthly (eg: a Group ALCo), with additional ad hoc reviews following a market stress event. The time taken to raise capital in the market is also significantly less than a 1-year capital horizon implies. We consider a 60 business day (or approximately 3 month) capital horizon to be sufficient.

The technical group also believes that the 1-year capital horizon is inconsistent with existing rules on trading book market risk. The proposed capital horizon of 60 days, together with a VaR confidence level of 99.9%, can be shown to be roughly consistent with the existing rules for market risk capital:

Existing Market Risk Charge = $3 \times 10\text{-day VaR at } 99\% \approx 60\text{-day VaR at } 99.9\%$ ¹

Proposed IDRC = 60-day default loss VaR at 99.9% (\approx 60-day ES at 99.73%)

Making such a definition also permits an economically meaningful aggregation of the MRC and IDRC, see the next point.

2.3 Aggregation with Existing Market Risk Charge

AIGTB WG Draft Principles (Principle E) appears to require banks to add together their existing VaR charges and the new IDR charge; that is, to employ the following formula for their Trading Book charge:

Total Trading Book charge = Existing Market Risk charge + New IDR charge (1)

If this is not what was meant by Principle E, then we welcome further discussion to clarify the intended meaning, and hope that the points made here and in the Annex will be useful to such a discussion. For the present discussion, we will assume that the definite meaning of Principle E is indeed to impose equation (1) as the means of calculating aggregate capital requirements.

The technical group's view is that such a prescription is neither economically realistic nor risk sensitive, and is therefore inappropriate. Equation (1) implies that losses from default are perfectly correlated with losses from market moves, which cannot be realistic for (at least) two reasons:

- There is an element of credit risk - *single name concentration risk* – which is in effect the operation of chance and whose independence from other risks is reliable and is implicit in the IRB approach itself (and in the original proposals of 2001 was even explicit, via the granularity adjustment). Recognizing this uncontroversial fact, but no other diversification effects, would lead to a rule significantly different from equation (1).

¹ Given a Gaussian loss distribution, the RHS of this equation is 8% greater than the LHS.

- There is no doubt that further diversification exists between market and (systematic) credit risk, even in a stressed market environment. While the level of this diversification is harder to measure, it has already been recognised within Strand 1 of the trading book proposals.

2.3.1 Single name concentration risk

Single name concentration risk is modelled and described as the risk associated with the happenstance of which particular obligors in a portfolio default. Because by definition it reflects the operation of chance on a single name, it cannot be correlated with any systematic factor (market or credit), since such factors operate on the portfolio as a whole.

The well understood behaviour of single name concentration risk is the whole basis for the IRB approach itself. A recent BIS Working paper on concentration risk² contains an excellent summary of the relatively well developed quantitative understanding of this risk.

Those single names whose default risk is relevant to the IDR charge are issuers or credit risky debt held in the trading book or reference entities of other credit instruments. The individual behaviour of those entities is not determined by where the instruments are held; in particular, single name concentration risk has the same characteristic of being independent from other risks in a trading book calculation, as in a banking book calculation.

We therefore regard it as uncontroversial that single name concentration risk should be treated as independent of VaR. This is a concrete proposal, leading to definite calculations alternate to (1). The exact calculation would depend on the modelling approach adopted by a particular bank, but we append an example (see Appendix 4.1) which captures the main features of this calculation. The basic idea is to measure ρ_{Eff} , the effective correlation between incremental default losses and market risk losses. Due to single name concentration risk, ρ_{Eff} will be less than 1 for any portfolio which is not perfectly granular. Given an estimate of this correlation a conservative aggregation rule might be formulated as:

$$\text{Trading Book Capital} = \sqrt{\text{MRC}^2 + \text{IDRC}^2 + 2\rho_{\text{Eff}} \times \text{MRC} \times \text{IDRC}} \quad (2)$$

It is important to note that we are not stating that the trading book *loss in the event of default* cannot be correlated with market risk; indeed we would expect the same considerations of downturn LGD risk, which is a systematic risk, to apply as in the banking book.

2.3.2 Other diversifications between market and systematic credit risk

In our discussion of single name concentration risk above, and in the example calculation, we have regarded the entire VaR capital charge as being composed of systematic credit risk (see equation (a.2)).

² Basel Committee on Banking Supervision Working Paper No. 15 “Studies on credit risk concentration: An overview of the issues and a synopsis of the results from the Research Task Force project”. November 2006. www.bis.org

This is of course the most conservative possible assumption, and is hardly realistic, although we noted above that the effect is nevertheless material. We now further note that further diversification, going beyond our discussion above and recognising that market risk is not pure systematic credit risk, has like single name concentration risk *already been recognised* by regulators. The Basel Committee and IOSCO have recognized the existence of imperfect correlation between market risk factors and credit risk in the context of Strand 1 of the trading book review. Own alpha multipliers explicitly reflect such correlations. In paragraph 120 of the Trading Book review document³, the regulators note that firms' internal estimates of alpha should "capture the material sources of stochastic dependency of distributions of market values of transactions across counterparties (e.g. the correlation of defaults across counterparties and between market risk and default)".

For this reason we regard equation (2) as conservative, since it implies perfect correlation between systemic credit losses and market losses. A more realistic approach would be to estimate the effective correlation between systemic credit losses and market losses, ρ_{Cr-Ma} . Techniques for estimating ρ_{Cr-Ma} could vary between institutions, we have described a couple of possible approaches in the Appendix 4.2.

2.3.3 Summary on aggregation

In view of the above we propose at a minimum that a correlation between the IDR charge and existing market risk charges of less than one be recognised due to the properties of single name concentration risk. For full consistency with other strands of the trading book review, however, banks should be able to model further diversification between systematic credit risk and the various risks making up the market risk charge. We are ready to discuss the implementation of such a framework in full detail.

³ "The Application of Basel II to Trading Activities and the Treatment of Double Default Effects", July 2005

3. Modelling Details

3.1 Constant Level of Risk

The member firms of the Associations are divided on the relevance and applicability of the concept of a constant level of risk to the modelling of the IDRC. In the following, the Technical Group neither condones nor rejects the concept, but clarifies its meaning and modelling implications.

The time horizon chosen for the measurement of capital (T_{Cap}) will not, in general, be equal to the liquidity horizon over which positions are held (T_{Liq}). Rather, we assume that banks maintain a constant level of risk over the capital horizon. That is to say, banks' exposures are frequently refreshed, and exposures which see significant change in their risk profile are sold and replaced with a new exposure of similar level of risk.

From a modelling perspective, the key consequence of a constant level of risk is that if the creditworthiness of an issuer deteriorates gradually over the capital horizon, it is reasonable to assume that the bank would defease its exposure to that issuer and avoid suffering a loss from default. On the other hand, issuers which default 'suddenly' (i.e. within a single liquidity horizon) would inflict credit losses on a liquidly traded portfolio. How big a reduction in risk this creates depends on the proportion of defaults that occur as a surprise, see point 3.3.

3.2 Liquidity Horizon

The liquidity horizon for a given position will depend on, for example, the position's credit rating, size and domicile. Banks will develop a simple model for allocating positions into liquidity buckets, with a floor of 10 days, consistent with the existing Trading Book rules.

The technical group recognises that a small minority of instruments in the Trading Book may have a liquidity period of more than 60 days, and that for such instruments a capital horizon of 60 days would not be appropriate. In exceptional cases, applying a capital horizon of up to one year will be justified.

The proposals outlined above would minimise the potential for so-called regulatory arbitrage by subjecting illiquid positions to a one year liquidity and capital horizon. Aggregation along the lines of equation (2) would result in the systemic component of the credit risk (i.e. the only risk measured under the Banking Book rules) of such positions being added to the market risk charge, while concentration risk would also be captured – see the Appendix for some illustrative calculations. In addition, such positions would generate capital from the market risk component of the Trading Book capital charge.

3.3 Short Horizon Probability of Default

The degree to which default risk is mitigated by liquidity will depend on the proportion of defaults which are preceded by a gradual deterioration in creditworthiness (and can thus be avoided), compared to the proportion of defaults which occur suddenly (and cannot be avoided). Wherever possible this proportion should be measured empirically, but in practice it may be difficult to obtain stable PDs for investment grade issuers at very short liquidity horizons due to the rarity of sudden default.

Where empirical data are not available, a number of techniques could be employed to model the likelihood of sudden default, which can lead to very different values of $PD(T_{Liq})$ and hence to a very different level of IDRC. We do not seek to prescribe a single modelling approach to compute $PD(T_{Liq})$, and indeed a wide range of approaches is available, but believe that, in selecting a methodology, firms should have regard to the following desirable properties:

- Ideally, recognition of the empirical fact that - particularly for investment grade issuers - most defaults do not happen suddenly. A consequence of this is that, for a given capital horizon, liquid instruments will receive a lower capital charge than illiquid instruments.
- Allocation of a PD greater than zero for all liquidity horizons, recognising that the possibility of sudden default does exist.
- Reproduction of the observed one-year PDs in the exceptional case of $T_{Liq}=1$ year. This will ensure consistency with the Banking Book and prevent regulatory arbitrage of illiquid instruments, see paragraph 2, section 3.2 above

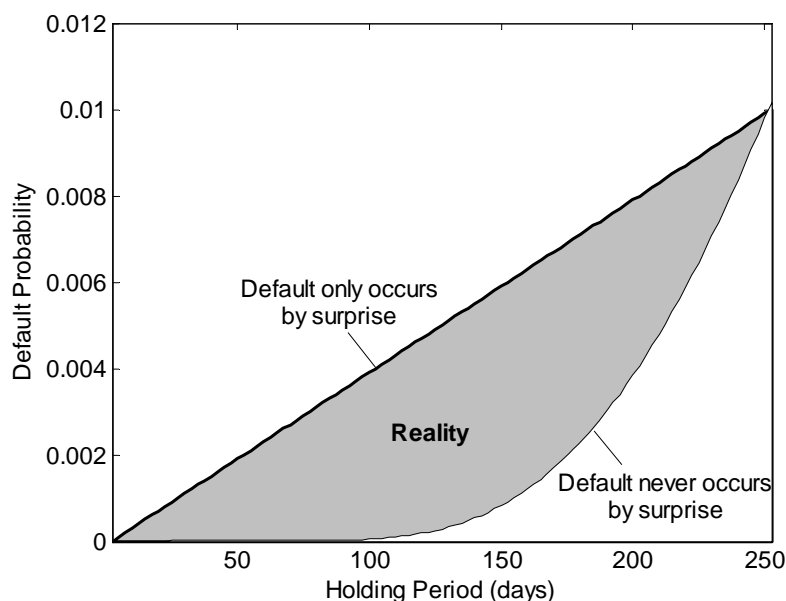


Figure 1: PD as a function of time, given that $PD(1 \text{ year}) = 1\%$

3.4 Loss Given Default

The recovery rate used to compute default losses should reflect empirical observation. A flat recovery rate of 40% for corporate issuers would be appropriate as a rule of thumb for corporate issuers; a more sophisticated approach could model recovery as a function of seniority. For ABS a slightly different approach is required, since these products become impaired, rather than simply defaulting. One approach to this would be to use the loss severity rates recorded by Moody's in their September 2004 paper 'Default & Loss Rates of Structured Finance Securities: 1993-2003'.

3.5 Recognition of Offsets

An important difference between the Banking Book and the Trading Book is the presence in the latter of many 'short' positions, which realise a profit in the event of default. The technical group regards it as uncontroversial that an economically realistic model of default risk must capture this effect, rather than simply excluding such positions from the regulatory capital calculation. If the IDRC includes systematic as well as name-specific default risk, this will mean that short positions will hedge the systematic default risk of long positions, even if the issuers in the short positions are different from the issuers in the long positions.

4. Appendix – Example Calculations of Correlation between VaR and IDR

4.1 Perfect correlation between Market losses and systemic Credit risk

We give an example calculation showing how a correlation of less than one naturally arises between market risk VaR and the IDR charge by taking account of single name concentration risk in the standard manner already prevalent in the Banking Book, even if no other diversification is recognised. The approach described below has been developed for illustrative purposes only. The technical group does not advocate the adoption of any particular model.

We assume that the VaR and IDR calculations are harmonised to a common time horizon. PDs are over that time horizon (the actual length of the horizon is not important to our conclusions). Further, although in practice the correlation calculation would depend on details of the IDR model, for simplicity we assume the IDR calculation is the IRB one factor model with buy and hold over the time horizon, instead of constant risk. As a result, we believe the levels of correlation indicated are probably a little high but nevertheless indicative of realistic ranges.

We suppose then that there are N obligors or reference entities (referred to simply as “obligors” below for brevity) in the trading book with default probabilities p_i and losses on default E_i , $1 \leq i \leq N$. PD of obligor i conditional on the systemic factor X is given by the usual dependence:

$$P_i(X) = \Phi\left(\frac{\Phi^{-1}(p_i) + \rho_i^{1/2} X}{(1 - \rho_i)^{1/2}}\right) \quad (\text{a.1})$$

The aggregate loss from default risk in the trading book is just $L_{IDR} = \sum_{i=1}^N E_i I_i$ where I_i is the indicator of default of obligor i ; thus I_i is 1 with probability $P_i(X)$ and 0 otherwise, and the suffix denotes that this is the risk against which the IDR charge should be calculated.

Next, as explained above, we will initially ignore diversification between systemic credit risk and market risk. We therefore assume that the market risk loss is a multiple of the normally distributed systemic credit factor:

$$L_{VaR} = S.X \quad (\text{a.2})$$

where S is a suitable proportionality factor. In what follows we shall choose S so that the standalone losses from market risk and default risk are roughly equal, though this may not necessarily be the case in practice. Systematic credit risk and market risk are now perfectly correlated.

Given a portfolio of homogenous obligors, one could then proceed to compute the correlation between L_{VaR} and L_{IDR} analytically. This would not, however, capture the true dependence between L_{VaR} and L_{IDR} , since correlation does not fully describe the relationship between losses

which are not jointly Gaussian. Instead we compute the Expected Shortfall⁴ of the total loss, $L_{Total} = L_{VaR} + L_{IDR}$, by numerical integration, giving total risk:

$$\text{Total Economic Risk} = \text{ES}_{99.73\%}[L_{Total}] = \text{ES}_{99.73\%}[L_{IDR} + L_{VaR}] \quad (\text{a.3})$$

Given this, one can reverse engineer the ‘effective correlation’, ρ_{Eff} , which can be used in equation (2) so that Trading Book Capital is equal to the Total Economic Risk.

The effective correlation will depend on the following characteristics of the credit loss distribution:

- Its magnitude, relative to the market VaR
- Its size, in terms of the number of assets in the portfolio
- Its granularity, i.e. how concentrated the exposures are
- The quality of its constituents.

Note that because we have (for now) chosen to assume perfect correlation between L_{VaR} and the systemic variable X , the effective correlation does not depend on the nature of a firm’s market risk. Hence this approach is only partially risk sensitive: increased systemic risk in a firm’s default exposure will, *ceteris paribus*, increase the total capital, but an increase in the systemic component of market risk will not.

We have computed (calculations performed independently by RBS and Citigroup) the 99.74th percentile Expected Shortfall of the total losses arising from a sample portfolio⁵, with the market P&L chosen to have approximately the same risk as the IDR. The results of this experiment are shown in Table 1.

$\text{ES}_{99.73\%}[L_{IDR}]$	\$2,349
$\text{ES}_{99.73\%}[L_{VaR}]$	\$2,173
Total Economic Risk	\$4,236
Effective Correlation	0.75
Incremental Default Risk	\$2,063

Table 1: Aggregating VaR and IDR given perfect systemic correlation

⁴ Note that we employ Expected Shortfall (ES) as a risk measure. Using ES to determine incremental default risk capital helps to avoid ‘cliff-edging’ effects, where (for example) a single large exposure with PD of 0.09% is not included in VaR, but an exposure with PD 0.11% is included.

Given a Gaussian loss distribution, ES with a confidence level of 99.73% generates the same level of capital as VaR at 99.9%. In practice, loss distributions are likely to be fat-tailed, hence the capital generated by ES at 99.73% would be greater than the capital from VaR 99.9%. We could equally well have used VaR at 99.9% confidence in the above analysis, the results on aggregation would be virtually identical.

⁵ The sample portfolio, supplied by Citigroup, is intended to represent to a ‘typical’ corporate bond portfolio in terms of credit quality and concentration. It does not correspond exactly to any portfolio actually traded by Citigroup or any other institution; the group does not accept responsibility for any conclusions based on the composition of this portfolio. Details of this portfolio are available from the authors.

We note that applying this approach to a granular, homogenous portfolio will result in an effective correlation of $\rho_{\text{Eff}} \approx 1$. Hence, in the limit of a Banking Book-style portfolio, a bank would add the IDR charge to the existing market risk charge.

4.2 Imperfect Correlation between Market losses and systemic Credit risk

We regard the approach just described as highly conservative, since it implies that there is perfect correlation between systemic credit risk and market risk losses. While the two are undoubtedly related; it is not plausible that market losses from a diversified Trading Book containing exposure to, for example, FX rates and commodity prices would be perfectly dependent with systemic credit quality. A more realistic approach is to specify $\rho_{\text{Cr-Ma}}$, the correlation between L_{VaR} and X . We then model⁶ L_{VaR} as

$$L_{\text{VaR}} = S\left(\rho_{\text{Cr-Ma}}X + \sqrt{1 - \rho_{\text{Cr-Ma}}^2}Z\right) \quad (\text{a.4})$$

where Z is standard normal and independent of X .

One simple, conservative approach to estimating $\rho_{\text{Cr-Ma}}$ is to assume that the correlation between market losses and systemic credit quality cannot be greater than the correlation between any given asset and systemic credit. A conservative estimate of $\rho_{\text{Cr-Ma}}$ would therefore be 0.36, the correlation implicit in the minimum Basel II asset-asset correlation coefficient of 0.12.

Alternatively, banks could measure the correlation between market losses and systemic credit spreads simulated in their VaR model. Such an approach would truly be risk sensitive, since a portfolio with VaR driven by credit spreads would result in a much higher value of $\rho_{\text{Cr-Ma}}$ than a portfolio with VaR dominated by, say, FX rates. A Trading Book dominated by exposures to credit risk might see $\rho_{\text{Cr-Ma}} \approx 0.75$, while a Trading Book diversified across asset classes would have significantly lower $\rho_{\text{Cr-Ma}}$.

Whichever approach is taken, an aggregate charge can again be computed by taking the Expected Shortfall of the joint loss distribution

$$\text{Total Economic Risk} = \text{ES}_{99.73\%}[L_{\text{Total}}] = \text{ES}_{99.73\%}[L_{\text{IDR}} + L_{\text{VaR}}].$$

The effective correlation between L_{VaR} and L_{IDR} can be computed as before.

We have performed this calculation for the sample portfolio using a range of values for $\rho_{\text{Cr-Ma}}$ (corresponding to a Trading Book with differing levels of credit spread risk). The resulting total capital and effective correlation for our sample portfolio is shown in Table 2. In all cases the incremental default risk is smaller than the standalone default risk. Note that for purposes of this calculation we have assumed that the standalone risks, $\text{ES}[L_{\text{VaR}}]$ and $\text{ES}[L_{\text{IDR}}]$ at a 99.73%

⁶ Equations (a.2) and (a.4) imply that market losses are themselves normally distributed. This is likely to be a good approximation in most cases; if market losses were materially non-Gaussian one could simply join L_{VaR} and X via Gaussian copula with the appropriate correlation parameter.

confidence level and 60 day capital horizon are approximately equal - this may not be the case in practice.

$ES_{99.73\%}[L_{IDR}]$	\$2,349					
$ES_{99.73\%}[L_{VaR}]$	\$2,173					
ρ_{Cr-Ma}	1	0.75	0.5	0.36	0.25	0
Total Economic Risk	\$4,236	\$3,939	\$3,596	\$3,420	\$3,359	\$2,981
Effective Correlation	0.75	0.52	0.26	0.14	0.10	-0.13
Incremental Default Risk	\$2,063	\$1,766	\$1,423	\$1,247	\$1,186	\$808

Table 2: Aggregating IDR and VaR for a range of systemic correlations

Summary

Our intention here is not prescribe any particular methodology, but rather to show that it is possible to aggregate VaR and IDR in a conservative yet economically realistic and risk sensitive way. In particular we have shown that for a concentrated Trading Book-style portfolio it is inappropriate to simply sum VaR and IDR, even using the most conservative possible assumption on the relationship between market losses and default losses.