CURRENT EXPOSURE METHOD FOR CCP'S UNDER BASEL III

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Abstract

Exposure-at-default is one of the most interesting and most difficult parameters to estimate in counterparty credit risk. Basel I offered only the non-internal Current Exposure Method for estimating this quantity whilst Basel II further introduced the Standardized Method and an Internal Model Method. Under new Basel III rules a central counterparty is defined as being a financial institution. New principles set out by the Basel Committee on Banking Supervision forces Central Counterparties in using the Current Exposure Method when estimating the credit exposures to Clearing Member banks notwithstanding its shortcomings. The Current Exposure Method relies on the Value-at-Risk methodology and its characteristics are discussed in this note. We will particularly investigate exposures to SAFCOM, the South African clearing house and point to a mathematical discrepancy on how netting is effected through the Basel accord.

Keywords: Exposure-at-default, EAD, Value-at-risk, VaR, Basel III, IOSCO, Current Exposure Method, CEM, Central Counterparty, CCP, Counterparty Credit Risk, CCR, Netting, Credit Conversion Factor, Default Fund

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Acknowledgements

The authors would like to thank the JSE and SAFCOM who provided the data used in this analysis. We also thank Prof Coenraad Labuschagne for valuable comments.

1. Introduction

The Basel Committee on Banking Supervision defines a central counterparty (CCP) as a clearing house that interposes itself between counterparties to contracts traded in one or more financial markets, becoming the buyer to every seller and the seller to every buyer and thereby ensuring the future performance of open contracts. Novation is the key but most important, for the purposes of the capital framework, a CCP is a financial institution (Basel, 2012). This is quite different to the Basel II framework. Due to this last point, the proposed Basel III reforms seek to require banks to more appropriately capitalise their exposures to CCPs, including both trade and default fund exposures (Laurens, 2012).

These viewpoint changes were in part due to the 2008 financial crisis. Derivatives were not the main reason for the crisis, but they were the underlying and accelerating factors that contributed to the crisis (Schwegler and Viviers, 2011). Before the 2008 crisis, the Basel II Framework allowed exposures to CCPs to be taken as nil – and, as such, provides significantly reduced capital charges for banks (Basel, 2006). The G20 Leaders, at their Pittsburgh summit in September 2009, encouraged the Basel Committee, among others, to create incentives to use CCPs (G20, 2009). The Committee has previously identified that the regulatory capital treatment for counterparty credit risk (CCR) was insufficient in a number of areas and that CCPs were not widely used to clear derivatives trades. With respect to CCPs, the Committee has been working to give effect to the creation of incentives for banks to increase the use of CCPs, while ensuring that the risk arising from banks' exposures to CCPs is adequately capitalized (Hull, 2012; Sawyer, 2010).

Where a bank acts as a clearing member of a CCP, either for its own purposes or as a financial intermediary between a client and a CCP, a risk weight of 2% must be applied to the clearing bank's trade exposure to the CCP in respect of over-the-counter (OTC) derivatives, exchange traded derivative transactions and Securities Financing Transactions (SFTs). The 2% risk weight for trade exposures also applies where the clearing member guarantees that the client will not suffer any loss due to changes in the value of its transactions in the event of a CCP default (Joosen, 2012, Basel, 2012). Banks are allowed in using either the internal models method (IMM), standardized method (SM) or current exposure method (CEM) when estimating the trade exposures (Balthazar, 2006).

However, clearing member banks do not just have trade exposures to CCPs, they also have exposures to the default funds. Many clearing houses already operate default funds but these were never compulsory. Under new CPSS-IOSCO Principles for Financial Market Infrastructures, a CCP can become a "qualified central counterparty" (QCCP) if it collateralise and manage a default or guaranty fund. The incentive is that clearing member banks would face a lower default fund capital charge if the CCP is qualified (Sawyer, 2010). However, if a CCP is non-qualifying, then the bank must apply the Standardized Approach for credit risk to the CCP and a risk weight of 1250% to their default fund contributions will be used (Basel, 2012).

The Safex Clearing Company (SAFCOM) is the only clearing house in South African and it was the first in world to be given "qualified" status at the end of 2012 (JSE, 2012). It promulgated rules to its newly formed default fund during March 2013 (JSE, 2013). However, SAFCOM did not have a default before this date. It was one of the main hurdles it had to overcome before it could be granted qualified status. During the crisis volatility increased massively and trading volumes of standerdised contracts decreased substantially after the crisis (Schwegler and Viviers, 2011). None the less, during the 2008 crisis, a few member brokers did default (Lehman Brothers being the biggest) but South Africa never had a clearing member that defaulted – Lehman Brothers was not a clearing member in South Africa.

Basel III states that default funds make CCPs safer from a systemic point of view, as they are used to mutualise losses when a clearing member defaults. In addition, default funds are frequently an important source of collateral that would be used to raise liquidity in the event of a participant default. Although CCPs have different waterfall structures to absorb and mutualise losses, the general order is the following (Arnsdorf, 2012):

a. posted collateral of the defaulted CM;
b. default fund contribution of the defaulted CM;
c. default fund contribution of the CCP; and
d. mutualized default fund contributions of non-defaulting CMs.

The fact that each CCP can set the level of its financial resources (margin and default funds) calls for a risk-sensitive approach that capitalises the default funds' exposure to each CCP according to the risk that the CM is facing (Basel, 2012). If a clearing member defaults, there are losses on the mutualised part of the default fund and all surviving clearing members are required to recapitalise the fund under CCP rules (Arnsdorf, 2012). This is extremely important due to the fact that many banks are also clearing members and they then need to quantify their exposures to the relevant default funds.

The new Basel III regulations set out three steps a bank has to implement when calculating its capital requirements held against its default fund exposures to QCCPs:

Step 1 - Calculation of the "hypothetical capital" (KCCP) - The rules require that CCPs use the Current Exposure Method (CEM) in performing this calculation, as this is the only simple approach that will ensure consistent and verifiable implementation (Basel, 2012);

Step 2 - Calculation of aggregate capital requirements;

Step 3 - Allocation of aggregate capital requirements to individual clearing members.

This document only entails step 1 where we discuss the CEM for listed derivative instruments. There are a few issues though. In general, banks are experienced with the current exposure method calculations but may not have the necessary information; CCPs should have the necessary information but may not have the CEM experience and may have confidentiality restrictions preventing them from sharing data with members (Bonini and Caivano, 2013). Further, verification of such calculations will also be essential (e.g. bank supervisors will need to confirm that banks have correctly calculated their exposures to, and capital requirements in respect of, CCPs).

This note discusses the CEM for listed derivatives and points to a mathematical discrepancy in the methodologies when excluding and including netting sets. The layout of this note is as follows: In section 2 we define exposure at default (EAD) and use this definition when we introduce the current exposure method in section 3. In section 4 we look at the relevant sections of the Basel III accord where it discusses the CEM when there are no bilateral agreements in place and netting can thus not be used to reduce the counterparty credit risk. We discuss an example where we use actual traded data. Section 5 introduces netting as set out in the Basel III accord and in section 6 we explain the similarities and differences between netting and the offsets used by SAFCOM. We again look at a practical real life example in explaining this. In section 7 we show the effect on the risk exposure if we net and do not net across instruments. This highlights the mathematical discrepancy eluded to. We conclude in section 8.

2. Exposure at Default

Counterparty credit risk is the risk that the counterparty to a financial contract will default prior to the expiration of the contract and will not make all the payments required by the contract. Exposure at default (EAD) is a parameter used in the calculation of economic capital or regulatory capital under Basel II and III for a banking institution (Hull, 2012; Turunen, 2010; Ross et al., 2007, Balthazar, 2006). It can be defined as the gross exposure under a facility upon default of an obligor. In general EAD can be seen as an estimation of the extent to which a bank may be exposed to a counterparty in the event of, and at the time of, that counterparty's default i.e., counterparty credit risk. EAD is equal to the current monetary amount outstanding in case of fixed exposures like term loans (Schanz and Dorval, 2011).

What will happen in practice is the following: If a counterparty to a derivative contract defaults, the CM must close out its position with the defaulting counterparty. To determine the loss arising from the counterparty's default, it is convenient to assume that the CM enters into a similar contract with another counterparty in order to maintain its market position. Since the CM's market position is unchanged after replacing the contract, the loss is determined by the contract's replacement cost at the time of default (Zhu and Pykhtin, 2007).

If the contract value is negative for the CM at the time of default, the CM

- closes out the position by paying the defaulting counterparty the market value (also known as the mark-to-market value) of the contract. Note that the market value or mark-to-market (MtM) is its current value, however, for an instrument that is margined on a daily basis (e.g., exchange traded derivatives) the MtM is the variation margin flow from the previous day to today;
- enters into a similar contract with another counterparty and receives the market value of the contract; and
- has a net loss of zero.

If the contract value is positive for the bank at the time of default, the CM

- closes out the position, but receives nothing from the defaulting counterparty;
- enters into a similar contract with another counterparty and pays the market value of the contract; and
- has a net loss equal to the contract's market value.

A simple example is a single derivatives contract. The credit exposure between a CM and a counterparty is the maximum of the contract's market value and zero.

3. The Current Exposure Method

The Basel documentation states: "Banks who do not have approval to apply the internal models method may use the Current Exposure Method." The Current Exposure Method (CEM) is used in determining the Exposure at Default (EAD) for a portfolio of instruments. The EAD is then used in determining the hypothetical capital. How do we determine the EAD using the CEM?

The current exposure is defined as the amount at risk should the counterparty default now and is normally assumed to be the market value also called the mark-to-market (MtM) value (Le Roux, 2008). The current exposure method measures the credit risk of losing anticipated cash flows from derivatives contracts like swaps, forwards and options in the event the counterparty to the contract should default. A listed derivatives contract is underwritten or guaranteed by the clearing house. The guarantee extends to both the buyer and the seller of the contract. The CEM is then used in calculating the credit risk a bank has towards a clearing house in the event that the clearing house should default. The CEM relies on the Value-at-Risk methodology (Alexander, 2008; Hull, 2012; Gregory, 2012).

Simply put, an investor's total exposure, under the current exposure method, is equal to the replacement cost of all marked to market contracts currently in the money, plus the credit exposure risk of potential changes in future prices or volatility of the underlying asset.

Basel II states: "Under the Current Exposure Method, banks must calculate the current replacement cost by marking contracts to market, thus capturing the current exposure without any need for estimation, and then adding a factor (the "add-on") to reflect the potential future exposure over the remaining life of the contract." We can state this differently: the CEM relies on the VaR methodology, and it has two components: the Current Exposure (CE) which is the current mark-to-market (MtM) value and a Potential Future Exposure (PFE) that is the maximum amount of exposure expected to occur on a future date, with a high degree of statistical confidence (Turunen, 2010; Le Roux, 2008; Schanz and Dorval, 2011). The PFE is obtained from the distribution of simulated counterparty exposures at a future time. Potential future exposures are used in setting counterparty credit limits for OTC trades and in determining economic and regulatory capital requirements (Ng et al, 2011).

MtM defines what could be potentially lost today with respect to a specific counterparty – this is known with certainty. The PFE is derived by multiplying the notional value of each contract with its Credit Conversion Factor (CCF) (Yang and Tkachenko, 2012). These factors are fixed and specified in the Basel II accord (Basel, 2006; Ross et al., 2007). The CCF is dependent on the asset class and on the remaining maturity of the contract. In contrast to Basel I, Basel II and III allow for collateral deduction in the CEM. However, note that non-cash collateral is subjected to a type-dependant haircut (Turunen, 2010).

Note that the CEM is criticized as being too simplistic in capturing the real credit exposures and risk. It has also not kept pace with changing times and the evolution of complex derivatives. Furthermore, it was introduced during 1988 and the credit conversion factors were never updated since. These factors were compiled for OTC derivatives and are now bluntly applied to liquid vanilla and complex exchange traded derivatives (Yang and Tkachenko, 2012). Much better alternatives are available for complex derivatives (Ng et al, 2011). Therefore the Basel Committee on Banking Supervision is considering alternatives (Becker, 2013).

Even so, due to the complexities of using the IMM or SM, many banks still estimate credit risk using the CEM. It is thus important in understanding it thoroughly. The exposure at default is mathematically stated as follows (Hull, 2013; Turunen, 2010, Taplin et al., 2007)

$$EAD = (RC + add\_on) - C_A \quad (1)$$

where

RC = the current replacement cost (mark-to-market or variation margin that has to be paid by the clearing member);

add_on = the amount for potential future exposure (PFE). This term will include netting if it is allowed ;

C_A = the volatility adjusted collateral amount.

We will now scrutinise equation (1) and implement it practically.

4. EAD without Netting[1]

In Figure 1 we show paragraph 92(i) on page 274 of the Basel II accord (Basel, 2006). We can state this paragraph differently: If counterparty credit risk is not mitigated in any way, the maximum loss that the CM can suffer, equals the sum of the contract-level credit exposures. This means we must determine the EAD for a particular CM by taking all the individual contracts that this CM clears, into account where netting or offsets are not allowed at all.

Let's assume that the total portfolio of trades cleared by this CM consists of a m instruments. Now, recall from section 2 that the credit exposure of a CM is the maximum of the contract's market value and zero. We are only interested in cash flows where the CM has to pay the variation margin (MtM) to another CM.

We will now look specifically at clearing member banks' exposure to SAFCOM, the South African clearing house. There are a few things we need to be aware of. Firstly, SAFCOM has a record of every single trade in the whole of the South African listed derivatives market down to client level. This means SAFCOM has a global view of everything happening in the market. Most clearing members use a clearing system called Nuclears and SAFCOM can filter trades either by clearing member, by client or by market. Secondly, clients' margins cannot be mingled with other clients' margins. Every client's margin account is segregated and ring fenced. The EAD will thus be calculated on an instrument level.

We can now define any CM's exposure at default as follows

$$EAD_{CM} = \sum_{i=1}^{m} \{\max[EAD_i, 0]\} \quad (2)$$

where

$$EAD_i = -\min[MtM_i, 0] + N_i f_i - I_i. \quad (3)$$

We further define

MtM_i = mark-to-market (variation margin) of the i-th instrument in the portfolio. Please note that the variation margin paid by a CM to SAFCOM, has a negative sign in the files obtained from the clearing system Nuclears. We only take contracts into account where the CM pays margin to SAFCOM i.e., where the CCP has credit risk towards a clearing member.

N_i = the notional value of the i-th instrument

f_i= the *credit conversion factor* (CCF) as specified in Figure 2.

I_i= initial margin (IMR) held against the i-th instrument (volatility based collateral C_A in equation (1))

m = the number of instruments in the portfolio under consideration

[1] Note that "netting" under Basel II is similar to the definition of "offset" for a portfolio of derivatives trades on the JSE i.e., for Class Spread Groups and Series Spread Groups as defined in the Safex Margining Technical Spec V3.04 found at http://www.jse.co.za/Markets/Equity-Derivatives-Market/Risk-management.aspx#Margin

Figure 1. Definition of the CEM in the Basel II accord

> 92(i) Under the Current Exposure Method, banks must calculate the current replacement cost by marking contracts to market, thus capturing the current exposure without any need for estimation, and then adding a factor (the "add-on") to reflect the potential future exposure over the remaining life of the contract. It has been agreed that, in order to calculate the credit equivalent amount of these instruments under this current exposure method, a bank would sum:
>
> - The total replacement cost (obtained by "marking to market") of all its contracts with positive value; and
> - An amount for potential future credit exposure calculated on the basis of the total notional principal amount of its book, split by residual maturity as follows:

Figure 2. The credit conversion factors (CCF) taken from page 274 paragraph 92(i) of the Basel II accord (Basel, 2006)

	Interest Rates	FX and Gold	Equities	Precious Metals Except Gold	Other Commodities
One year or less	0.0%	1.0%	6.0%	7.0%	10.0%
Over one year to five years	0.5%	5.0%	8.0%	7.0%	12.0%
Over five years	1.5%	7.5%	10.0%	8.0%	15.0%

Further note that $N_i f_i$ is the add_on mentioned in equation (1). Another point worth mentioning is that when applying the CCF to interest rate derivatives like bond futures and bond index futures, one should use the maturity of the underlying cash bond as the tenor. As an example let's look at the government bond with code R186. This bond has a maturity of 21 December 2026. There are listed futures on this bond and for a 3 month R186 future, one should use the tenor of the R186 cash bond when applying the CCF. This future's tenor will thus fall in the "over 5 years" category and the CCF will be 1.5%. For futures on bond indices, one should use the weighted average time to maturity (WATM) of all the bonds comprising the index. The South African All Bond Index (ALBI) currently has a WATM of 10.56 years.

Equation (3) is the Exposure at Default for the i-th instrument in the portfolio. This is just equation (1) written in terms of SAFCOM data (extracted from Nuclears). The first term on the left hand side of equation (3) is $\min[RC_i, 0]$. This implies, the only trades taken into account are those with a credit risk to the CM i.e., trades where the CM has to pay variation margin to the clearing house. However, when we add the add_on (the second term in equation (3)), we take all trades into account. In essence, this is a conservative view where we assume that all trades have the potential in moving against the CM over time.

Let's look at a specific example taken from actual trades on 1 March 2011. This is set out in Table 1. These are all equity derivative instruments on the books of a particular CM. By applying equations (2) and (3) we determine the EAD for this clearing member equal to R212,123 for these 20 instruments (R is the abbreviation for the South African currency called the RAND. The international code is the ZAR).

Table 1. Calculating the EAD according to equation (2) and (3) for a portfolio of instruments

Variation Margin per Instrument / trade	Variation Margin PAID by CM	Notional Exposure Value	Expiry Time	Credit Conversion Factor	Basel Add-on	IMR per Trade	Total Exposure	Basel III Exposure
-33,083	33,083	2,311,485	0.79178	6.00%	138,689	1,151,275	-979,504	-
-501	501	45,351	0.04384	6.00%	2,721	5,582	-2,360	-
-50	50	61,555	0.04384	6.00%	3,693	7,753	-4,009	-
5,680	-	19,071	0.29041	6.00%	1,144	41,505	-40,361	-
23,310	-	4,321,650	0.04384	6.00%	259,299	334,916	-75,617	-
-3,040	3,040	271,290	0.04384	6.00%	16,277	31,011	-11,693	-
6,600	-	172,500	0.04384	6.00%	10,350	15,505	-5,155	-
-2,020	2,020	223,320	0.04384	6.00%	13,399	28,530	-13,111	-
-5,100	5,100	576,220	0.04384	6.00%	34,573	22,803	16,870	16,870
5,100	-	576,220	0.04384	6.00%	34,573	44,656	-10,082	-
-75	75	5,790	0.04384	6.00%	347	930	-508	-
-4,460	4,460	419,000	0.04384	6.00%	25,140	54,579	-24,979	-
-13,311	13,311	753,678	0.04384	6.00%	45,221	105,437	-46,905	-
-29,500	29,500	925,325	0.04384	6.00%	55,520	97,684	-12,664	-
4,004	-	241,644	0.04384	6.00%	14,499	45,152	-30,653	-
-1,830	1,830	188,250	0.04384	6.00%	11,295	26,049	-12,924	-
-237	237	163,955	0.04384	6.00%	9,837	16,126	-6,051	-
-6,112	6,112	3,857,597	0.29041	6.00%	231,456	42,315	195,253	195,253
46	-	34,001	0.04384	6.00%	2,040	4,342	-2,301	-
-63	63	24,369	0.04384	6.00%	1,462	3,535	-2,010	-
							EAD	212,123

5. EAD Incorporating Netting

Calculating the EAD for a portfolio of derivatives is quite simple if netting is not allowed. However, the exposure or EAD can be reduced greatly by means of netting agreements (Hull, 2012; Balthazar, 2006). A netting agreement is a legally binding contract between two counterparties that, in the event of default, allows aggregation of transactions between two counterparties i.e., transactions with negative value can be used to offset the ones with positive value and only the net positive value represents credit exposure at the time of default (Zhu and Pykhtin, 2007). In the South African derivatives world we talk about "offsetting." The portfolio scanning margining methodology used when trading derivatives on the JSE allows for offsetting. Offsetting is only allowed on a client basis and only for certain groups of instruments. Netting's scope can be wider if there are bilateral contracts in place between different clients or members of a particular CM. This is not currently allowed in South Africa.

Let's now incorporate netting according to the Basel II accord. Figure 3 shows another extract from the Basel II accord.

Figure 3. Netting according to paragraph 96(iv) on page 275 of the Basel II accord

96(iv). Credit exposure on bilaterally netted forward transactions will be calculated as the sum of the net mark-to-market replacement cost, if positive, plus an add-on based on the notional underlying principal. The add-on for netted transactions (A_{Net}) will equal the weighted average of the gross add-on (A_{Gross})[251] and the gross add-on adjusted by the ratio of net current replacement cost to gross current replacement cost (NGR). This is expressed through the following formula:

$$A_{Net}=0.4*A_{Gross}+0.6*NGR*A_{Gross}$$

where :

NGR=level of net replacement cost/level of gross replaceent cost for transactions subject to legally enforceable netting agreements[252]

[251] A_{Gross} equals the sum of individual add-on amounts (calculated by multiplying the notional principal amount by the appropriate add-on factors set out in paragraph 92(i) of this Annex) of all transactions subject to legally enforceable netting agreements with one counterparty.

The equation above (giving the add-on or PFE) has since been amended to read

$$A_{net} = add\_on = ((1-\rho) + \rho * NGR) * A_{Gross}. \quad (4)$$

where
A_{Gross} = the sum of all individual add_on amounts (calculated by multiplying the notional principle amount by the appropriate credit conversion factors given in Figure 2 – see equation (1));
NGR = the level of net replacement cost divided by the gross replacement cost;
ρ = the correlation factor determining the amount of offset available.

The following holds for the correlation factor ρ

$$0 \le \rho \le 1$$

We currently have $\rho = 0.85$ as set out in the newest document (Basel, 2012). NGR determines the ratio of long contracts to short contracts. Thus, the total credit exposure created by all transactions in a netting set (i.e., those under the jurisdiction of the netting agreement) is reduced to the maximum of the net portfolio value and zero such that

$$EAD_{netset} = \max[EAD_{Net}, 0] \quad (5)$$

where

$$EAD_{Net} = RC_{Net} + A_{Net} - C_{Net}. \quad (6)$$

We now have

$$RC_{Net} = -\sum_{i=1}^{m} \min(0, MtM_i) \quad (7)$$

and the complement of RC_{Net} is

$$RC'_{Net} = \sum_{i=1}^{m} \max(0, MtM_i) \quad (8)$$

where MtM_i is the mark-to-market (variation margin) for the i-th instrument in the netting set. RC_{Net} is the net replacement cost or the total variation margin paid by the CM. If the CM receives variation margin $RC_{Net} = 0$. Furthermore we have

$$C_{Net} = \sum_{i=1}^{m} I_i + max\left[0, \sum_{i=1}^{m} MtM_i\right] \quad (9)$$

with I_i the initial margin (IMR) or collateral held against the i-th instrument. The second term is the positive cash flow (variation margin) a CM receives from the mark-to-market of this instrument. A_{Net} is given in equation (4). From this we define

$$A_{Gross} = \sum_{i=1}^{m} N_i f_i \quad (10)$$

where (see description below equation (3))
N_i = the notional value of the i-th instrument
f_i= the credit conversion factor as shown in Figure 2.

NGR is defined to be the ratio of net replacement cost to gross replacement cost of transactions subject to the netting agreement. In other words, it is the net Mark-to-Market divided by the gross Mark-to-Market value of the transactions or the *full netted position* divided by *position under no netting*. Let's define the total variation margin either paid or received as follows

$$MtM_T = \sum_{i=1}^{m} MtM_i. \quad (11)$$

MtM_T can be positive or negative. The following holds

$$MtM_T < 0 \text{ then CM pays variation margin away}$$
$$MtM_T \ge 0 \text{ then CM receives variation margin}$$

We now define NGR as follows (using equations (8), (9) and (11)),

$$NGR = \frac{ABS(MtM_T)}{-\sum_{i=1}^{m}\{min[0, MtM_i]\} + \sum_{i=1}^{m}\{max[0, MtM_i]\}} = \frac{|MtM_T|}{RC_{Net} + RC'_{Net}}. \quad (12)$$

In essence, NGR is the percentage of longs to shorts in a portfolio or percentage of variation margin paid to the clearing house versus the total gross variation margin cash flow. It is a measure of the amount of offset (or netting) allowed in a defined netting set. As an example, let's assume that the $NGR = 40\%$. From equation (3) we have $(0.15 + 0.85 * 40\%) = 49\%$ and an offset of 49% will be allowed.

NGR has some interesting dynamics. The following holds

$$0 \le NGR \le 1$$

By using equation (4) we can determine the level of netting in the limits when $NGR = 0$ and $NGR = 1$:

$$A_{net} = (1-\rho) * A_{Gross} \quad if \quad NGR = 0 \quad (13)$$

$$A_{net} = A_{Gross} \quad if \quad NGR = 1. \quad (14)$$

Equation (13) shows we gain maximum benefits from netting if $NGR = 0$. This leads to $A_{net} = 0.15 * A_{Gross}$ currently while there are no benefits when $NGR = 1$. This is shown in Figure 4.

Let's look at an example where we use the same data shown in Table 1. We now assume we can net across all 20 instruments in this portfolio. The results are given in Table 2. These results show that the EAD for this set of instruments is equal to zero. Netting can thus reduce the EAD substantially.

Figure 4. Net exposure as a function of the NGR factor

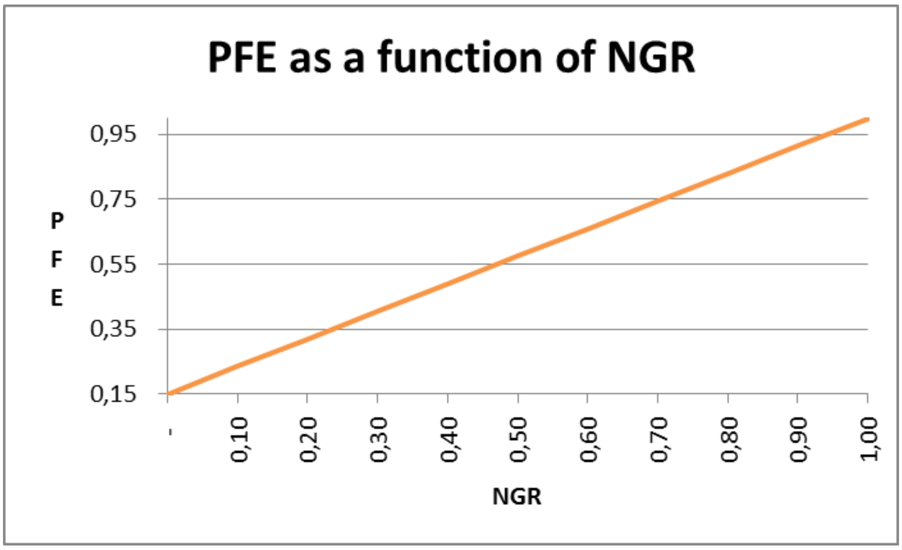

Table 2. Calculating the EAD by netting across instruments

BASEL III Exposure incorporating NETTING	
RC (Variation Margin Paid OUT)	54,641
Net Replacement Cost	54,641
Gross Replacement Cost	144,121
NGR	37.91%
A_{Gross}	911,536
A_{net} (Add-On)	430,486
$RC + add\_on$	570,019
Variation Margin Received	-
Initial Margin on Deposit	2,079,684
C_{net} (total collateral)	2,079,684
$RC + add\_on - C_{net}$	-1,509,665
	0

6. Basel Netting versus SAFCOM Offsets

Netting should be implemented in a similar way to the offsets that are currently achieved through the JSE's portfolio margining system. This means we need to go down to client level and netting will only be allowed per client, and only for the groups of instruments as defined by the JSE. In practice this means a client's trades will only be netted if those instruments are allowed to have offset margins in the margining system e.g., calendar spreads can be netted and a EURZAR contract can be netted against a USDZAR contract. However, there is no netting between a USDZAR and an ALSI contract or between most single name futures.

We can also extend Equation (5) to include more than one netting set. If there are p netting sets in the total portfolio of a particular CM, the total EAD for this CM is given by

$$EAD_{CM} = \sum_{i=1}^{p} EAD_i \quad (15)$$

with EAD_i given in equation (5) being the EAD for a particular netting set i – group of instruments for a particular client. Further we need the total PFE or add-on for a particular CM defined by

$$A_{CM} = \sum_{i=1}^{p} A_{Net}^{i} \quad (16)$$

where A_{Net}^{i} is given in equation (4) being the add-on for netting set i.

7. Discrepancy between Methodologies

The way the Basel accord prescribes the CEM has a mathematical illogicality or contradiction. There is no continuous mathematical mapping when we move from excluding netting in total to a netting methodology – going from estimating the EAD as described in section 4 to the methodology set out in section 5. This is explained through the following data set. In Table 3 we list 20 actual commodity trades done on 1 March 2012. If we exclude any netting, and use equations (2) and (3) we estimate the total EAD = R27,253,882.

However, if we allow all 20 trades to belong to one netting set we estimate the EAD to be zero by applying Equation (5). The results are shown in Table 4. Further, if we use the methodology described in Section 4, and we let NGR=100% (i.e., we exclude any netting as defined in the accord), we estimate the EAD = R22,711,516 according to Equations (4) and (5) (see Table 5). This is far from zero. It seems there is an discrepancy in the formulation when netting is introduced or when new bilateral netting agreements are put in place.

Table 3. Calculating the EAD according to equation (2) and (3) for a portfolio of commodity derivatives

Variation Margin per Instrument/trade	Variation Margin PAID by CM	Notional Exposure Value	Expiry Time	Credit Conversion Factor	Basel Add-on	IMR per Trade	Total Exposure	Basel III Exposure
1,250	-	861,250	0.21918	10.00%	86,125	37,500	48,625	48,625
-137,950	137,950	21,394,500	0.21918	10.00%	2,139,450	969,000	1,308,400	1,308,400
-13,500	13,500	2,143,000	0.38630	10.00%	214,300	95,000	132,800	132,800
198,791	-	32,857,000	0.21918	10.00%	3,285,700	1,236,000	2,049,700	2,049,700
4,800	-	1,129,800	0.38630	10.00%	112,980	42,000	70,980	70,980
-500	500	153,000	0.80548	10.00%	15,300	6,000	9,800	9,800
783,020	-	163,151,100	0.38630	10.00%	16,315,110	9,643,813	6,671,298	6,671,298
2,100	-	3,399,900	0.21918	10.00%	339,990	205,188	134,803	134,803
1,822,600	-	155,903,200	0.38630	10.00%	15,590,320	8,348,366	7,241,954	7,241,954
-95,800	95,800	10,974,600	0.05753	10.00%	1,097,460	610,634	582,626	582,626
-2,301,000	2,301,000	181,071,000	0.33425	10.00%	18,107,100	14,754,075	5,654,025	5,654,025
-2,000	2,000	3,660,000	0.50411	10.00%	366,000	333,425	34,575	34,575
-3,200	3,200	661,200	0.38630	10.00%	66,120	68,212	1,108	1,108
83,795	-	2,095,503	0.55890	10.00%	209,550	1,756,455	-1,546,905	-
4,880	-	2,903,551	0.38630	10.00%	290,355	669	289,686	289,686
-41,250	41,250	1,977,250	0.05753	10.00%	197,725	83,866	155,109	155,109
-52,000	52,000	35,828,000	0.21918	10.00%	3,582,800	1,585,824	2,048,976	2,048,976
125	-	436,375	0.38630	10.00%	43,638	19,060	24,577	24,577
-20,300	20,300	419,500	0.21918	10.00%	41,950	19,000	43,250	43,250
94,100	-	13,500,900	0.38630	10.00%	1,350,090	598,500	751,590	751,590
								27,253,882

Table 4. Calculating the EAD by netting across instruments

BASEL III Exposure incorporating NETTING	
RC (Variation Margin Paid OUT)	**0**
Net Replacement Cost	**2,667,500.02**
Gross Replacement Cost	**5,662,961.02**
Incorporate NETTING	**YES**
NGR	**47.10%**
A_{Gross}	**63,452,062.88**
A_{net} (Add-On)	**39,957,688.59**
$RC + add\_on$	**39,957,688.59**
Variation Margin Received	**327,960.98**
Initial Margin on Deposit	**40,412,586.14**
C_{net} (total collateral)	**40,740,547.12**
$RC + add\_on - C_{net}$	**-782,858.53**
	0

Table 5. Calculating the EAD by excluding netting

BASEL III Exposure without NETTING	
RC (Variation Margin Paid OUT)	**0**
Net Replacement Cost	**2,667,500.02**
Gross Replacement Cost	**5,662,961.02**
Incorporate NETTING	**NO**
NGR	**100.00%**
A_{Gross}	**63,452,062.88**
A_{net} (Add-On)	**63,452,062.88**
$RC + add\_on$	**63,452,062.88**
Variation Margin Received	**327,960.98**
Initial Margin on Deposit	**40,412,586.14**
C_{net} (total collateral)	**40,740,547.12**
$RC + add\_on - C_{net}$	**22,711,515.76**
	22,711,516

8. Conclusion

In this note we discussed the current exposure method as set out in the Basel II and III accords. The CEM is used in calculating the credit risk between two counterparties where it estimates the Exposure at Default (EAD) for a portfolio of instruments. The current exposure is defined as the amount at risk should the counterparty default now. The CEM was originally introduced for OTC derivatives instruments only while Basel III extended the scope to listed derivatives and central counterparties.

We explained the current exposure method when we exclude and include netting sets as applied to listed derivative instruments. We implemented this by using actual traded data obtained from the JSE and the South African clearing house SAFCOM. Also emphasised were the similarities between SAFCOM's definition of "offset margins" or discounts used in their portfolio scanning methodology and "netting sets."

The results highlighted a mathematical discrepancy between the methodologies when we incorporate and exclude netting across instruments as defined in the Basel accord.

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