Counterparty Credit Risk | Evolution of the standardised approach to determine the EAD of counterparties

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This article focuses on Counterparty Credit Risk. The topic of this article is on the evolution and need of standardised method for the assessment of Exposure at Default of counterparties and their Capitalisation under regulatory requirements.

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This Article is part of the CH&Co. Global Research & Analytics Team (GRA Dept.) and supported by the CIB expertise team of CH&Co.

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In this Article, we have made a focus on the new standard methodology (SA-CCR) for computing the EAD related to Counterparty Credit Risk portfolios. The implementation of a SA-CCR approach will become increasingly important for the Banks given the publication of the finalised Basel III reforms; in which it will require from financial institutions to compute an output floor to compare their level of RWAs between Internal and Standard approaches.

This document aims at summarizing the main information about the SA-CCR methodology displayed in the regulatory document. For more details or practical examples regarding the computation of the SA-CCR components; one may refer to the bcbs279 text.

Context & Regulatory Requirement

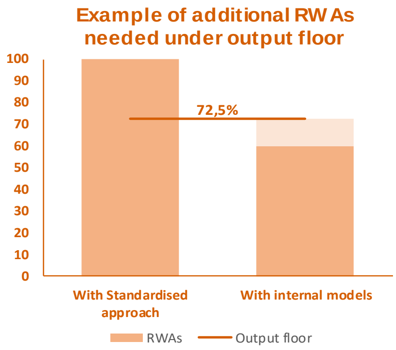
Under Basel regulatory requirement, Banks have to carry **Capital** in order to ensure their business continuity (either on retail or market activities). This regulatory Capital corresponds at least to a minimum amount related to the Banks' positions and defined by the European supervisor in the CRR (Capital Requirement Regulations).

In the context of Counterparty Credit Risk, Banks have to estimate their potential economic loss in case of its obligor default. However, given the bilateral nature of the activity and considering the uncertainty relative to the market evolution; the main component of the Counterparty Credit Risk assessment relies on the estimation or forecast of the counterparties' exposure. For the modelling and calculation of **EAD** under counterparty credit risk, Banks may use either **Internal Model Methodology (IMM)** or **Standard Methodology (MtM / SM or SA-CCR).** Standard methodologies are put in place when a Bank cannot implement its own IMM approach; thus, regulator proposed simplistic and conservative standard formulas; the so-called CEM/SM or SA-CCR approaches.

However, given that the regulation is evolving, and the regulator published its **final SA-CCR[1] text** as of March 2014; Banks will have to **replace** both current non-internal model approaches (CEM and SM) with the SA-CCR one as it has been put in place to address the deficiencies of these current methodologies.

In addition, with the publication of the **finalised Basel III[2] reforms;** Banks using their own internal methodologies (IMM) will also have to compute RWAs under the new standard approach (i.e. the SA-CCR methodology) since it will become mandatory for the computation of the output floor.

Recall that the 2017 reforms replace the existing capital floor with a more robust, risk-sensitive output floor based on the revised standardised approaches. In other words, Banks' calculations of RWAs generated by internal models cannot, in aggregate, fall below 72.5% of the risk-weighted assets computed by the standardised approaches.



According to the Basel III reforms Banks have from January 2022 and until January 2027 to implement the final version of the output floor.

[1] See bcbs279 - The standard approach for measuring counterparty credit risk exposures - BIS - March 2014 (revised Apr. 2014).
[2] See d424 - Basel III: Finalising post crisis reforms - BIS - December 2017.

Current Standard Approach

In this section it is recalled briefly the formulas used for the computation of exposure amounts under the CEM methodology and then a focus is done on the drawbacks of the current standard approach.

For the **Counterparty Credit Risk**, to calculate RWAs under standardised approach Banks must use:

- The exposure amounts under a standard approach (CEM/SM) planned to be replaced by the **SA-CCR** methodology according to bcbs279.
- Those amounts must then be multiplied by the relevant borrower **risk weight using the standardised approach** for credit risk to calculate RWA.

The CEM methodology is one of the current standard approach used for the computation of exposure amounts; it is defined in the article 274 of the CRR[3] as the Mark-to-Market method (MMM). Under this methodology, **the EAD is computed at netting set level and then aggregated at counterparty level**, it is made of two components:

- The **current market value** (CE or current exposure) of the instrument, which represents the replacement cost of the contract. In the eventuality of a counterparty's default, it corresponds to the cost for the Bank to enter into a similar position with another counterparty to maintain its market position.
- The **potential future exposure** (PFE) corresponding to the potential evolution of the contract market value and increase in exposure over a one-year time horizon.

The EAD being written as follows:

$$\boldsymbol{EAD_{CEM} = CE_{net} + PFE_{net}}$$

Where:

- $\boldsymbol{CE_{net}} = Max(0; \sum_i PV_i)$ where PV_i is the value of the trade at the netting set level.
- $\boldsymbol{PFE_{net}} = \sum_i AddOn_i\,(0.4 + 0.6 * NGR)$
  - With $AddOn_i = Notionnal * Supervisory\ Factor$
  - And NGR[4] is the Net-to-Gross Ratio: $\boldsymbol{NGR} = \frac{Max(0; \sum_i PV_i)}{\sum_i Max(0; PV_i)}$ which aims at capturing the counterparty's netting ratio.

[3] Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012

[4] Article 298 of the CRR - 26 June 2013

The **supervisory factors** are introduced in the paragraph 2 of the Article 274; they are function of the trade's underlying and remaining maturity:

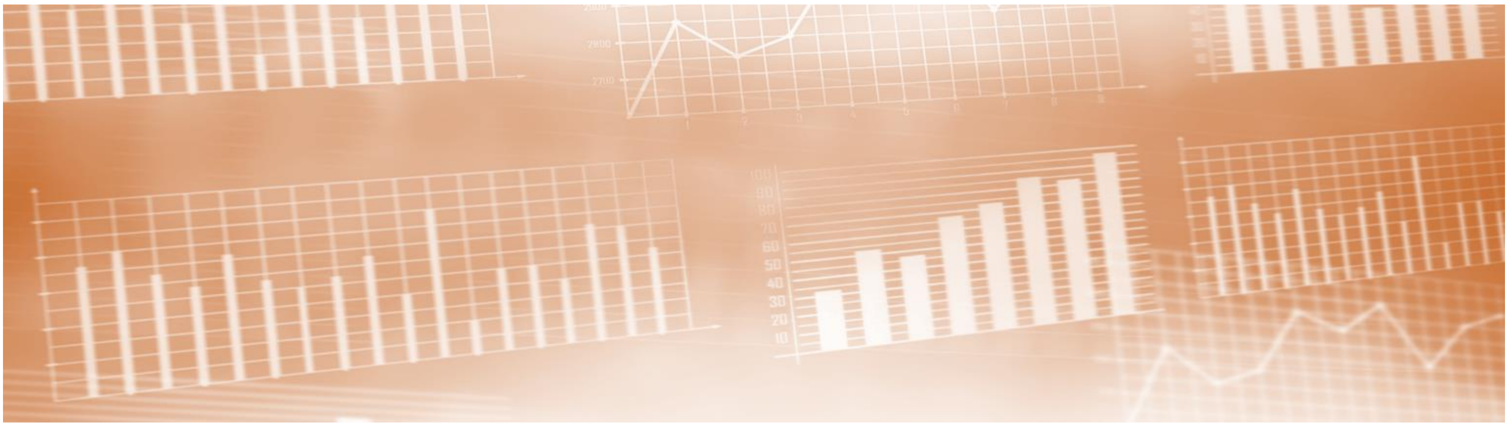
Residual Maturity	Interest rate contracts	Contracts concerning foreign-exchange rates and gold	Contracts concerning equities	Contracts concerning precious metals except gold	Contracts concerning commodities other than precious metals
One year or less	0%	1%	6%	7%	10%
Over one year, not exceeding five years	0,5%	5%	8%	7%	12%
Over five years	1,5%	7,50%	10%	8%	15%

Pros & Cons

The CEM or SM approaches have been criticised due to their many shortcomings. As such, Regulator defined in bcbs279 the **SA-CCR** approach in order to address those deficiencies. In the below, it is presented the benefits of the new methodology but also its new disadvantages or challenges:

- Better recognition of collateral and hedging / netting benefit
- Differentiation between margined and unmargined trades
- PFE components calibrated under a stress period
- More risk sensitive

- New data requirement
- Implementation cost
- Alpha parameter too conservative?
- Potential limited netting benefits
- IM impact understated on the PFE?
- Additional supervisory monitoring



SA-CCR methodology

As already highlighted, the definition of the SA-CCR methodology has been undertaken by regulator to answer the shortcomings of the original standard approach introduced in the CRR (article 274 for the CEM and Article 276 for the SM). The idea being to still rely on the simplicity and benefits of the current CEM approach. **As such, the EAD under the new approach is defined as follows:**

$$EAD = \alpha * (RC + PFE)\ where\ PFE = Multiplier * AddOn$$

Where:

- α is a supervisory factor already used in IMM and set to the minimum value of 1.4 for the SA-CCR computation.
- RC and PFE are still the replacement cost and potential future exposure as introduced in the context of the CEM but having now a sounder definition.

As explained in bcbs279, now the following distinctions are made when computing the replacement cost or the potential future exposure:

- The replacement cost is computed at netting set[5] level and distinguishes now margined and un-margined transactions. As such formulas have been designed to consider all the form of collateral given at the initialisation of the trades but also all the exchanges of variation margins that could happen during the life of the transaction.
- The computation of the potential future exposure is now more granular as the trades are first assigned to a netting set, asset classes and hedging set to then compute the several components of the PFE add-on. The final add-on is obtained as reverse aggregation up to the netting set level, and then the multiplier of the netting set is applied to deduce the PFE of netting set.

In the next section it is briefly presented the formulations of both the RC and PFE as well as their computation steps.

[5] Regarding cases of multiple margin agreements and multiple netting sets; those are detailed in the Articles 185 to 187 of bcbs279.

On the RC computation

For unmargined trades

$$RC = Max(V - C; 0)$$

Where V correspond to the current market value of the transactions and C is the collateral held by the bank at the netting set.

For margined trades

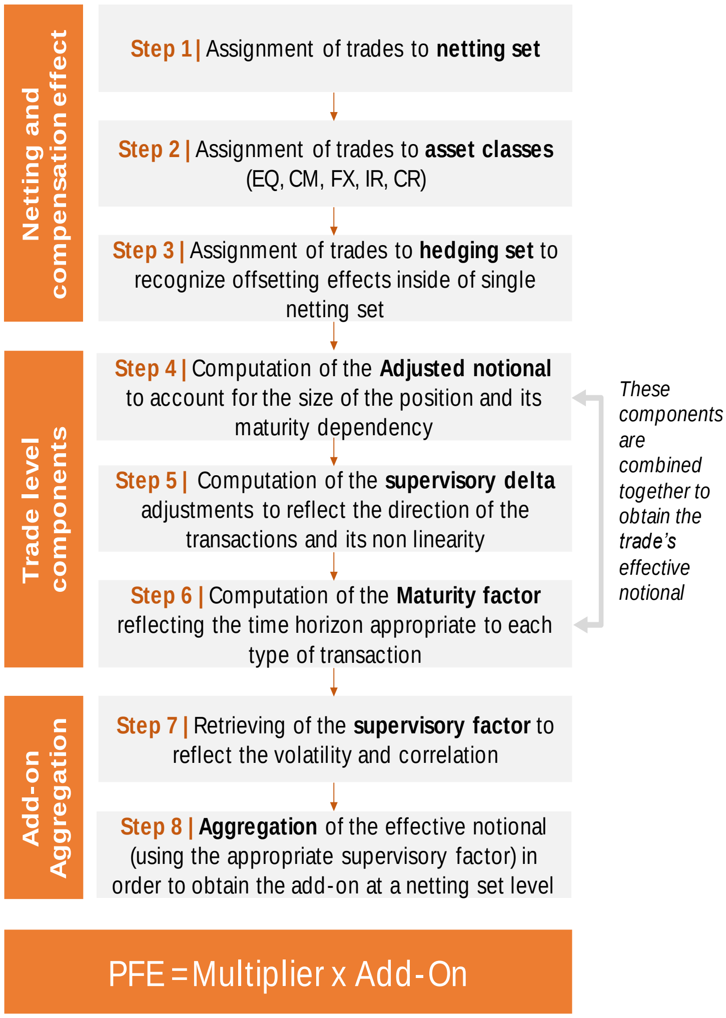
$$RC = \max(V - C; TH + MTA - NICA; 0)$$

Where the features of the collateral standard agreements (Threshold - TH, Minimum Transfer Amount - MTA and net independent amount - NICA) are accounted to determine the maximum amount that would not trigger a VM call.

On the PFE computation[6]

The PFE consists in the computation of an add-on (whose intent is to capture the potential future increase in exposure) to which is applied a multiplier used to scale it down to recognise the benefits of potential collateral excess or negative Mark-to-Market.

The step-by-step process to determine the add-on component of a netting set is described in the following right-hand side figure.



$$\textbf{\textit{Multiplier}} = \min\left\{1; Floor + (1 - Floor) * e^{\left(\frac{V-C}{2*(1-Floor)*AddOn}\right)}\right\} \quad where\ Floor = 5\%$$

[6] For more details on the supervisory delta values or the list of supervisory factors; the reader may refer to the related article in bcbs279 (Article 159 and Article 183 respectively).

Focus on the Add-on components

The add-on formulation differs from an asset class to another (Interest rates, Foreign Exchange, Credit, Equity, commodity). For each asset class, it is recalled the formulas relative to the add-on computation.

Add-on for interest rate derivatives

The SA-CCR allows full recognition of off-setting positions within a maturity bucket and partial offset across maturity bucket. Thus, as a first step, the Effective notional D_{jk}^{IR} is computed for time bucket *k* of a hedging set *j* (i.e. currency):

$$D_{jk}^{IR} = \sum_{i \in \{Ccy_j,\ MB_k\}} \delta_i * d_i^{IR} * MF_i$$

Where notation $i \in \{Ccy_j,\ MB_k\}$ refers to trades of currency *j* that belong to maturity bucket *k*; and δ_i, d_i^{IR}, MF^i corresponds to the supervisory delta adjustments, trade-level adjusted notional amounts and the maturity factor respectively.

Regarding the maturity factor parameter, it is worth noting that a distinction is made between margined and unmargined transactions (regardless of the asset class):

$$MF_i^{unmargined} = \sqrt{\frac{\min\left(M_i, 1\ year\right)}{1year}} \text{ and } MF_i^{margined} = \frac{3}{2}\sqrt{\frac{MPOR}{1year}}$$

Where M_i is the maturity of the transaction *i* and $MPOR_i$ the margin period of risk of the margin agreement containing the transaction.

Then the offsetting[7] across maturity buckets for each hedging set is computed as follows:

$$Effective\ Notional_j^{IR} = \sqrt{\left(\sum_{k \in \{1,2,3\}} (D_{jk})^2\right) + 1.4\left(D_{j1}D_{j2} + D_{j2}D_{j3}\right) + 0.6D_{j1}D_{j3}}$$

Finally, the hedging set level add-on is calculated using the interest rate supervisory factor and then the aggregation across hedging sets is performed via summation:

$$AddOn_j^{IR} = SF_j^{IR} * Effective\ Notional_j^{IR}$$

$$AddOn^{IR} = \sum_j AddOn_j^{IR}$$

[7] Banks may choose to not recognise offset across maturity buckets. In this case, the relevant formula is: $Effective\ Notional_j^{IR} = \left|D_{j1}^{IR}\right| + \left|D_{j2}^{IR}\right| + \left|D_{j3}^{IR}\right|$

Add-on for foreign exchange derivatives

The hedging set corresponds to all the FX currency pairs present in the netting set. The effective notional of a hedging set is defined as:

$$Effective\ Notional_j^{FX} = \sum_{j \in HS_j} \delta_i * d_i^{FX} * MF_i$$

And then the add-on of a hedging set corresponds to the product of the absolute value of the effective notional with the FX supervisory factor:

$$AddOn_{HS_j}^{FX} = SF_j^{FX} * \left|Effective\ Notional_j^{FX}\right|$$

The final add-on netting set level is then the sum of all the hedging sets add-on included in the netting set:

$$AddOn^{FX} = \sum_j AddOn_{HS_j}^{FX}$$

Add-on for credit derivatives

For Credit derivatives, all trades referencing the same entity *k* (either a single entity or an index) are allowed to offset each other fully. Thus, leading to the following entity-level effective notional amount:

$$Effective\ Notional_k^{Credit} = \sum_{i \in Entity_k} \delta_i * d_i^{Credit} * MF_i$$

Then, the add-on at entity level is obtained as the product of the effective notional and the appropriate supervisory factor (single name or credit indices):

$$AddOn(Entity_k) = SF_k^{Credit} * EffectiveNotional_k^{Credit}$$

Once the add-on at entity level determined, they cannot fully offset each other instead a partial offsetting is applied via the use of a single-factor model that divide the risk of the asset class into a systematic component and an idiosyncratic one. The add-ons can offset each other fully in the systematic component; whereas there is no offsetting benefit in the idiosyncratic component. The degree of offsetting within the credit derivatives asset class is done using a correlation factor ρ_k that distinguish single name from credit indices:

$$AddOn^{Credit} = \sqrt{\left(\sum_k \rho_k^{Credit} * AddOn(Entity_k)\right)^2 + \sum_k \left(1 - \left(\rho_k^{Credit}\right)^2\right) * AddOn(Entity_k)^2}$$

Add-on for equity derivatives

The add-on formula for equity derivatives is similar with the one for credit derivatives as it relies on the same approach. First, the offsetting benefits and construction of add-ons at entity level *k* are done and then a partial offsetting using a single factor model is put in place to divide the risk into a systematic and idiosyncratic component (with a distinction between single equity and index).

Thus, the entity-level effective notional amount and add-on formulas are:

$$Effective\ Notional_k^{Equity} = \sum_{i \in Entity_k} \delta_i * d_i^{Equity} * MF_i$$

$$AddOn(Entity_k) = SF_k^{Equity} * EffectiveNotional_k^{Equity}$$

Finally, the add-on for the equity asset class is as follows:

$$AddOn^{Equity} = \sqrt{\left(\sum_k \rho_k^{Equity} * AddOn(Entity_k)\right)^2 + \sum_k \left(1 - \left(\rho_k^{Equity}\right)^2\right) * AddOn(Entity_k)^2}$$

Add-on for commodity derivatives

For commodity derivatives, the offsetting benefits are allowed between the trades of commodity *k* in hedging set *j* (corresponding to the hedging set). For each commodity type, it is first computed the effective notional amount and its associated add-on:

$$Effective\ Notional_k^{Com} = \sum_{i \in Type_k^j} \delta_i * d_i^{Com} * MF_i$$

$$AddOn\left(Type_k^j\right) = SF_{Type_k^j}^{Com} * EffectiveNotional_k^{Com}$$

Then, to obtain the add-on at hedging set level, a single factor model is put in place; where full offsetting is permitted between each add-on of a same commodity type and a partial offsetting is allowed within each add-on of hedging set of a same type of commodities:

$$AddOn_{HS_j}^{Com} = \sqrt{\left(\rho_j^{Com} \sum_k AddOn\left(Type_k^j\right)\right)^2 + \left(1 - \left(\rho_j^{Com}\right)^2\right) \sum_k AddOn\left(Type_k^j\right)^2}$$

Finally, no offsetting benefits is permitted between hedging sets; thus, the final asset class add-on is as follows:

$$AddOn^{Com} = \sum_j AddOn_{HS_j}^{Com}$$

To conclude, the below table summarises the EAD computation under the SA-CCR approach (RC and PFE components):

SA-CCR - EAD components			IRD	CRD	EQD	CMD	FXD
RC	Unmargined		$\max(V - C; 0)$ where V are the value of the derivative transactions in the netting set and the C value of the colaltéral held				
RC	Margined		$\max(V - C; TH + MTA - NICA;\ 0)$ where TH is Threshold and MTA the Minimum Transfer Amount of the CSA and NICA the Net Indepent Collateral Amount				
PFE	Netting & Hedging set		A separate Hedging set is created for each currency j then a split by maturity bucket is applied : $\boldsymbol{MB_1}$: $Maturity < 1\ year$ $\boldsymbol{MB_2}$: $1\ year \leq Maturity \leq 5\ years$ $\boldsymbol{MB_3}$: $Maturity > 5 years$	Entity	Entity	Energy Agricultural Metal Other	Currency Pair
PFE	Adjusted notional - Trade level		$d_i = N_i * \frac{e^{-0.05S_i} - e^{-0.05E_i}}{0.05}$ Where S_i and E_i are the start and end dates[1] respectively and N_i is the trade notional amount.		$d_i = Q_i * S_i$ Where Q_i is the number of unit referenced by the trade and S_i is the spot value of one unit of the contract.		$d_i = N_i^{for\ leg} * ccy_{for/dom}$
PFE	Delta Adjustment - Trade level		For instruments that are not options or CDO tranches $\delta_i = \begin{cases} 1\ for\ long\ instrument \\ -1\ for\ short\ instrument \end{cases}$ For Call / Put options or CDO tranches specific formulas exist (based on the directionality of the products) and can be found at the para 159 of Bcbs 279				
PFE	Maturity Factor - Trade level		$\begin{cases} MF_i^{unmargined} = \sqrt{\frac{\min(M_i; 1\ year)}{1\ year}} \quad where\ M_i\ is\ the\ transaction\ remaining\ maturity\ floored\ by\ 10\ business\ days \\ MF_i^{margined} = \frac{3}{2}\frac{\sqrt{MPOR_i}}{1\ year} \quad where\ MPOR_i\ is\ the\ margin\ period\ of\ risk\ appropriate\ for\ the\ margin\ agreement\ containing\ the\ transaction\ i \end{cases}$				
PFE	Supervisory parameters	Supervisory Factor (SF)	0.50%	**Credit Single Name:** From 0.38% to 6% based on the rating **Credit Index:** $\begin{cases} Investment\ Grade: 0.38\% \\ Speculative\ Grade: 1.06\% \end{cases}$	**Equity, Single Name:** 32% **Equity, Index:** 20%	**Electricity:** 40% **Oil/Gas:** 18% **Metals:** 18% **Agricultural:** 18% **Others:** 18%	4%
PFE	Supervisory parameters	Correlation (ρ)	N/A	**Credit Single Name:** 50% **Credit Index:** 80%	**Equity, Single Name:** 50% **Equity, Index:** 80%	40%	N/A
PFE	Effective Notional		$D_{jk} = \sum_{i \in (Ccy_j, MB_k)} \delta_i * d_i * MF_i^{type}$ $EffNot_j = \sqrt{\left(\sum_k (D_{jk})^2\right) + 1.4(D_{j1}D_{j2} + D_{j2}D_{j3}) + 0.6D_{j1}D_{j3}}$	$EffNot_k = \sum_{i \in Entity_k} \delta_i * d_i * MF_i^{type}$		$EffNot_k = \sum_{i \in Type_k^j} \delta_i * d_i * MF_i^{type}$	$EffNot_j = \sum_{i \in HS_j} \delta_i * d_i * MF_i^{type}$
PFE	Add-on - Aggregated		$AddOn = \sum_j SF_j * EffNot_j$	$AddOn(Entity_k) = SF_k * EffNot_k$ $AddOn = \sqrt{\left(\sum_k \rho_k AddOn(Entity_k)\right)^2 + \sum_k (1 - (\rho_k)^2)(AddOn(Entity_k))^2}$		$AddOn(Type_k^j) = SF_{Type_k^j} * EffNot_k$ $AddOn = \sum_j \sqrt{\left(\rho_j \sum_k AddOn(Type_k^j)\right)^2 + (1 - (\rho_j)^2) \sum_k \left(AddOn(Type_k^j)\right)^2}$	$AddOn = \sum_j SF_j * \lvert EffNot_j \rvert$
EAD			$EAD = \alpha * (RC + PFE)\ where\ PFE = Multiplier * AddOn\ \&\ multiplier = \min\left\{1; Floor + (1 - Floor) * e^{\left(\frac{V-C}{2(1-Floor)AddOn}\right)}\right\}\ and\ Floor = 5\%$				
RWA (IRBA)			$RWA = 12{,}5 * 1{,}06 * EAD * LGD * f(PD) * g(M, PD) \quad where \quad f(PD) = N\left(\frac{1}{\sqrt{1-R}} * N^{-1}(PD) + \sqrt{\frac{R}{1-R}} * N^{-1}(0{,}999)\right) - PD \quad and \quad g(M, PD) = \frac{1 + (M - 2{,}5)b}{1 - 1{,}5b}$				