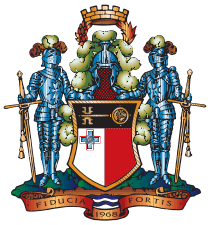

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THE CREDIT RISK THRESHOLD MODEL

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BOX 5: THE CREDIT RISK THRESHOLD MODEL

The Central Bank of Malta has complemented its suite of analytical models with a Credit Risk Threshold Model (CRTM). The model aims to quantify credit risk arising from new borrower defaults in the performing loan portfolio of selected banks against banks' loss absorption capacity consisting of collateral, collective provisions and capital.[1] Credit risk is measured off a simulated loss distribution, taking into consideration individual bank defaults simulated by the model. Bank specific sectoral default rates and NPL ratios are used as input for the model, together with banks' loan portfolio specificities. Credit risk indicators, such as Expected Loss, Value-at-Risk and Expected Shortfall are derived from the loss distribution. The model assumes that banks can tap into their allocation of collective loan loss provisions and collateral liquidation in order to absorb the estimated losses.

Simulating new borrower defaults

The CRTM employs a Monte Carlo simulation engine to simulate the asset value of each borrower at granular level as a combination of idiosyncratic and sectoral (exogenous) shocks, i.e. the asset value of the borrower is assumed to be determined by both a sectoral shock (which is based on the pairwise correlation among the sectoral NPL ratios) and an idiosyncratic shock based on a random error term. The following is a mathematical representation of the simulation function:

$$X_{i,s,t} = \left[r_s Y_t + \varepsilon_{i,s,t} \sqrt{1 - r_s^2} \right]$$

where:

$X_{i,s,t}$	is the simulated asset value of borrower i in sector s
r_s	represents a sectoral factor weight and takes values between 0 and 1
Y_t	is the matrix of correlated sectoral NPL ratios at time *t* representing the exogenous shock
$\varepsilon_{i,s,t}$	is a matrix of standard normal random numbers representing the borrower specific (idiosyncratic) risk factor

The value of r_s determines the weight to be placed on the idiosyncratic and sectoral shocks. When r_s= 0, the asset value of the borrower is determined entirely by the error term $\varepsilon_{i,s,t}$ i.e. the idiosyncratic shock, whereas if r_s=1, the asset value of the borrower is determined solely by the sectoral shock. Following sensitivity analyses, the value of r_s is set at 0.5. Hence, the borrower value is determined by both the idiosyncratic and sectoral shocks. The exogenous shock targets all borrowers within an economic group and its impact can be amplified by similar shocks applied to sectors that are directly correlated.

The model is repeated for 5,000 scenarios. The simulated asset values are then compared against a sectoral default threshold p_s, derived from observed default rates, with new defaulting borrowers identified as those with a simulated asset value that falls below the respective threshold. All loans belonging to defaulting borrowers in each scenario are aggregated to represent the overall loss. The losses generated from each scenario are then combined to form the loss distribution.

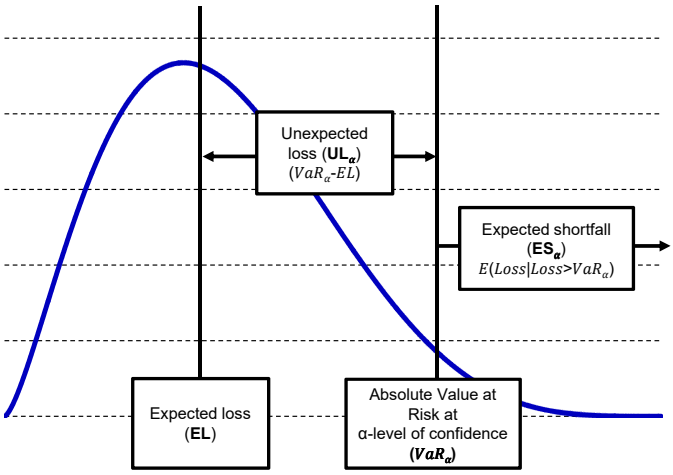
Loss Distribution

The following credit risk parameters are inferred from the loss distribution (see Chart 1); (i) the Expected Loss (EL), which is equal to the average of the distribution, (ii) the Absolute Value-at-Risk (VaRα), which at the α-level of confidence covers both the EL and the Unexpected Loss and represents the

[1] The selected banks include core domestic banks and four non-core banks that hold a sufficiently large loan portfolio for which significant results can be obtained from the CRTM.

α-percentile of the distribution and (iii) the Expected Shortfall (ES), which is defined as the expected value (probabilistic average) of the losses exceeding the VaRα (located in the right tail of the distribution). The expected shortfall thus provides a measure of capital that would be required as a buffer to absorb losses arising from extremely low probability, but high impact, events.

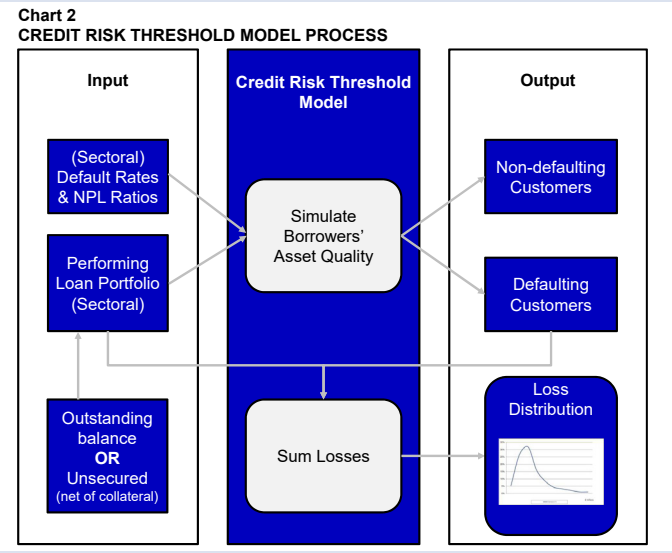
Chart 1
LOSS DISTRIBUTION



Model Output

Chart 2 provides a schematic representation of the process involved in the simulation of credit risk losses by the CRTM. The model provides two sets of outputs for each bank, one assuming that the reported value of collateral attached to defaulting loans can be fully recovered, and in the other instance, the loan losses are borne entirely by the bank collective provisions (as a primary loss absorption) and capital, thus assuming, at the extreme, that no value whatsoever is recovered from the available collateral.

Chart 2
CREDIT RISK THRESHOLD MODEL PROCESS



The two sets of outputs, at the two confidence levels, produce linear ranges of values for each credit risk indicator. Both outputs allow easy inference of the minimum recovery of collateral that is necessary for the banks to still satisfy the regulatory capital requirements. The effectiveness of collective provisions in absorbing the EL is also considered, whilst any uncovered losses (not absorbed through collateral and provisions) are charged directly to capital.

The model is run bi-annually, with the output presented to the JFSB. The model output is also used as input to the *Report* as well as for other analyses conducted within the Financial Stability Department.