

Time for an overhaul?

Mark Hodgson of Solens Consultants shows how a Monte Carlo simulation-based package developed for Basel II can be used to produce values of default probability and provisioning in practice, which has effectively contributed to completing structured finance solutions for mining projects.

In one of my previous articles (GTR, May/June 2005, p54), an approach was described whereby the risk and reward relationship for a transaction could be measured and accordingly the basis for determining the optimum pricing for a transaction could be determined.

In this paper, the approach described has been applied to a number of mining project proposals as a means of determining their likely creditworthiness.

Accordingly, the nature of the risks have been clarified so that it is possible to determine those issues which are of key significance to the success or failure for a particular structured trade or project finance transaction.

In the examples below, the transactions and associated background are real, however key identifying elements have not been described, so as to respect confidentiality issues. All the transactions involved focus on the mining industry – a highly topical area given the recent upsurge in metal prices.

As noted in the previous article, the initial aim of the tool described herein as QVS (quantitative valuation of significance) was to provide a means for banks to meet their obligations under Basel II. It is now clear that by providing a process to measure the level of provisioning needed in such transactions, it necessarily follows that banks are then in a position to modify the structure in order to meet the operational capabilities of the client.

Key definitions used

For the purposes of reference the key measures are defined below:

- PD is the probability of default, as defined by the incidence of the borrower being unable to meet debt service obligations within a 12-month period.

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- EAD is exposure at default, the exposure on the obligation at the time of default and expressed in a monetary amount.
- LGD is loss given default, the fraction of the EAD that will not be recovered following a default and therefore expressed as a percentage.

Here, two measures will be used. The first is default loss (DL), ie, that loss incurred prior to the perfecting of security, mainly by way of conventional debt recovery processes. The second type of loss takes into consideration the potential for accessing tangible security (eg, contractual obligations, stocks, etc), and is termed the secured loss (SL), as would be the case for most structured trade-based transactions.

QVS method used

QVS is a convenient acronym developed for the tool and

represents ‘quantitative valuation of significance’. It is based on standard Monte Carlo simulation techniques where the output has been additionally processed to provide the key parameters as defined under Basel II. The most important types all graphical output which are generated by QVS are

the loss distribution functions (LDFs). The diagnostic loss distribution function described today is that which measures the EAD for both DL and SL conditions.

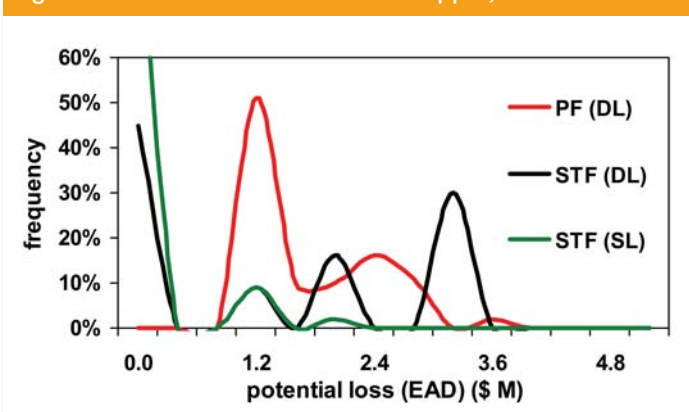
QVS acts as a module which is superimposed on the cashflow that has been developed to describe the debt facility as developed with a client. After the Monte Carlo simulations, the data were analysed to produce LDFs and associate measures of risk adjusted return on capital (Raroc), PD and provisioning. Fictional company names have been used to describe the different mining projects involved. The names have some allusion to the location and commodity, but are for convenience only.

Case study 1: SeuroCopper

This project financing considered a lengthy tenor up to eight years, with a drawdown period of the first five years. As in many projects currently proposed, a secondary metal occurred with the primary – in this case gold occurs with copper, and consequently the project could benefit from the upturns in both metal prices, thereby mitigating product payment risk. Default was defined as a breach of one of a number of conventional ratios that are used in project finance (PF), examples being DSCR (debt service coverage ratio) and LLR (loan life ratio).

A review of the operational details quickly showed that the capitalisation facility as requested by the client would probably be ambitious given the capacity of the mine to produce an adequate amount of saleable concentrate. On applying QVS, it quickly became apparent that a breach would be a virtual certainty.

Figure 1: EAD Distribution for SeuroCopper; PF/STF Facilities



GTR

Restructuring the transactions as a structured trade finance (STF) facility and thereby changing criteria for which a default would occur had a significant impact (see Figure 1). Consequently, it was then possible to advise the client that a shorter-term, less ambitious credit facility should be constructed, which would then potentially meet the risk/reward requirements of the bank. Discussions continue.

Case study 2:
RusGold

This refers to a case where it was necessary to determine the best options for funding a comprehensive capitalisation programme for a gravity concentration plant treating open pit feed. The quality of the original geological data implied that the scope of the investment plan would necessitate a combination of both debt and equity.

The subsequent QVS outputs for two different funding approaches, debt only and equity + debt produced the following EAD LDFs shown in Figure 2.

The EAD profiles therefore demonstrated the value of revising the proposed project financing in terms of both equity

Case study 3:
MideZinc

This recently privatised base metal operation wished to raise its initial commercial financing on the basis of debt only. The level of the financing requirement is such that despite a wide range of variables, the subsequent likelihood of a default is small as shown in the EAD graph (Figure 3).

This EAD profile represents one of the best profiles observed to date, which additionally takes into consideration parameters measuring the impact of country risk.

Here, the impact of an adverse country risk event was modelled as an interruption to production; the importance of the operations to the country's economy means that a termination of operations is unlikely.

As shown, using a security package typical of that used in STF transactions, the likelihood of a loss is modelled as being virtually nil. As a result, this transaction was approved by credit committee and is now moving forward accordingly.

Production of
provisioning
estimates

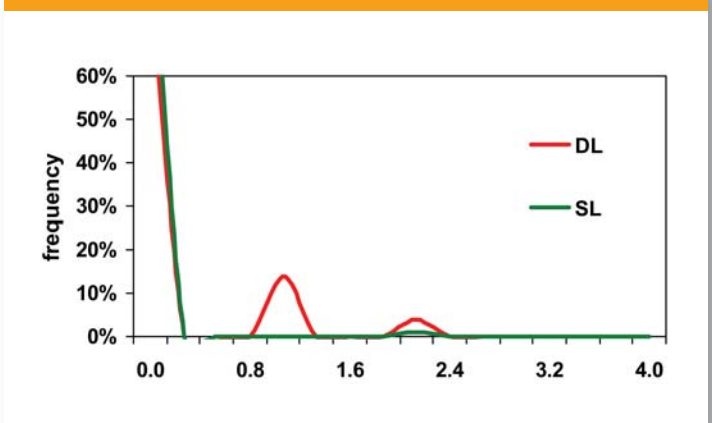
The calculation of meaningful

finance (PF). However, the description of what constitutes the procedure for determining the provision amount under Basel II is limited essentially to a weighting system based on 'slotting criteria'. These are 30 categories of risk for which each may be rated as low, medium or high. Depending on the overall average of the scores allotted the following weightings can

The LDFs for the three facilities are shown in figure 4, in which the recorded loss is expressed as a fraction of the maximum loss recorded for all the simulations run.

The subsequent provisions for each facility could therefore be derived from an analysis of the curves above. The closest statistical distribution fitting such loss curves is a beta distribution, for which a mean (μ) and

Figure 3: EAD Distribution for MideZinc: Debt Facility



then be applied: strong: 70%; good: 90%; satisfactory: 115%; weak: 250%.

This weighting system allows for an interpretation being made, that the provision could exceed the actual amount lent. Since the assignment of scores for the various slotting criteria is semi-quantitative, it is not unreasonable that the overall scope for the slotting criteria might vary with the weighting assigned.

In QVS the following relationship is used:

Weighting applied (%) = 250 / slotting score.

The better the risk, the higher the slotting score, hence the smaller the weighting that needs to be applied. The highest slotting score that is theoretically possible would be 3.

Most STF transactions would have slotting scores of between 1 and 2.2 (given the focus on emerging markets: hence weighting would be 115-250%). These weightings are then applied to the maximum loss as defined under a given statistical distribution as derived from the LDFs.

standard deviation (σ) can be determined.

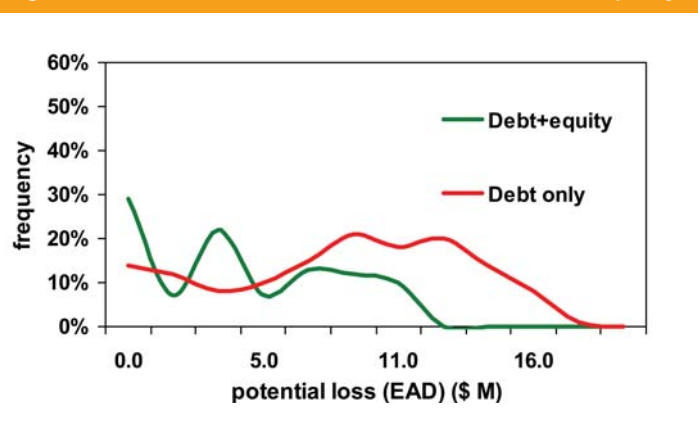
QVS uses the above criteria as set out by Basel II but uses this system as one means of approximating the actual provisioning amount required. In QVS the following relationships are used:

$$\text{Provision amount} = \text{EL}_{\text{max}} + \text{UL} + \text{OpRisk}; \text{EL}_{\text{max}} = \text{PD.LGD} \cdot (\mu\text{EAD} + 2 \cdot \sigma\text{EAD})$$

The provisioning amount must take into account the maximum possible losses that are likely to be incurred. The argument being that the provisioning amount should not be more than the sum of the total expected and unexpected losses that are likely to be observed, plus the provision for operational risk. Figure 5 compares the maximum loss as defined as that occurring within 95% of the distribution limits and the associated provision as determined using the formulae given above.

The level of provisioning (based on DL events) is expressed relative to the relevant debt

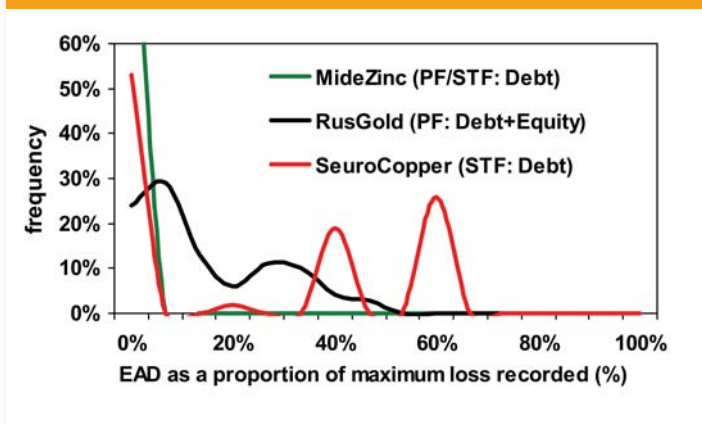
Figure 2: EAD Distribution for RusGold; Debt vs. Debt+Equality



injection and debt. The client has been advised accordingly and new proposals are being tabled to produce a more robust cashflow, which would then be bankable.

provisioning amounts is the cornerstone of the Basel II accord, certainly as far as specialised lending is concerned, which is the appropriate category for commodity finance (CF), trade finance (TF), STF and project

Figure 4: LDFs for the Three Facilities



amount and therefore become analogous to the Cooke ratio. The 'average' figures relate to the average of the three independently generated measures for provisioning, the maximum loss for the LDF distribution functions, the RWA (risk weighted asset amount, as defined under Basel II) and the sum of the losses (EL, UL and OpRisk).

As shown, the first two projects (SeuroCopper and RusGold), for which there was a significant potential for a default, produce correspondingly high provisioning levels.

The converse is true of the third, (MideZinc) case, for which the implied level of provision would be 4%, ie, half the arbitrarily defined Cooke level.

Consequently, it can be seen that QVS produces provisioning results that directly relate to the capability of a borrower to perform and, provided the structure is suitably robust, can provide measures of

provisioning that would be significantly less than those implied either by the application of the Cooke ratio alone or by assuming that normally country risk default levels be applied. In the case of the latter, I am aware of some banks applying country risk weighting in a way that produces the levels of provisioning that are prohibitively high. QVS provides a means of justifying lower levels of provisioning so that Raroc can exceed the transaction hurdle rate.

Justifying the investment

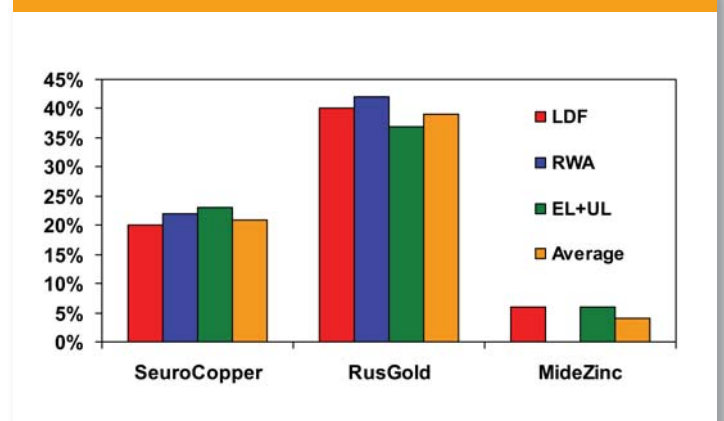
As described in my earlier article, the main reason for the development of QVS was the identification of a need for a tool that provides a sound basis for justifying a bank's investment in a PF/STF transaction while meeting the needs of Basel II. What passed for a provision on the basis of the application of

the (8%) Cooke Ratio now does not seem to provide adequate protection of bank interests given the various (draconian) interpretations being made for Basel II.

The QVS approach provides a different method of determining the provision, in which the level of provision is determined by the effectiveness of the structure developed and its suitability within the specific market environment.

As a result, QVS should and does provide the user with a clear idea of when a structure needs to be overhauled to achieve a satisfactory Raroc, so that the transaction can be carried forward with confidence noting the changes that will inevitably take place in the future.

Figure 5: Maximum Likely Statistical Loss: Provisioning



Abbreviations and equations used

A	Advance made to borrower
EL	Expected loss
m	Coefficient used in calculation of operational risk provision
OpRisk	Operational risk requirement in provision (defined below)
UL	Unexpected loss
β	Beta for operational risk
σ	Volatility: standard deviation associated with losses in general
σ_{credit}	Standard deviation associated with unexpected loss
EL	The expected loss and is based on the envisaged likelihood of a default as expressed by PD. Hence the expected loss can be defined as: $EL = LGD \cdot PD \cdot EAD$
UL	The unexpected loss on the individual loan is usually expressed as the standard deviation of the credit (σ_{credit}) of the overall advance amount (A)
UL	(as a proportion) = $\sigma_{\text{credit}} = LGD \cdot \sqrt{PD \cdot (1-PD)}$
UL	(as a monetary value) = $\sigma_{\text{credit}} \cdot A$
Operation risk provision	= $\beta \cdot m \cdot A = 0.15 \cdot 0.035 \cdot A$