# Quantifying the op risk in investment fund valuation

Fund management is often forgotten in the wider push towards quantitative operational risk management. Here, François Longin and Gautier Martin take a closer look at the operational risk that accompanies fund valuation

Modelling the losses due to operational risk in asset management is a thorny issue. But for fund valuation in particular, investors are able to better control this risk using the loss process approach (LPA) – a framework consistent with the Basel Committee on Banking Supervision's ongoing work on capital adequacy at financial institutions.

The process of valuing collective investment tools is both complex and opaque. Even though the very notion of operational risk is still relatively vague, headway can be made when focusing on operational risk in the valuation business line.

Using techniques and results from an earlier study by French bank CCF (a member of the HSBC group), the operational risk inherent in fund valuation will be defined more clearly and a method for quantifying this risk proposed. It's hoped that the basic method could be developed and used in a variety of contexts. In addition to being used in risk capital allocation and as a yardstick for charging clients, it may also serve as a new quality indicator for the valuation process.

There must be as many definitions of operational risk as there are financial institutions. In one formulation, the Basel Committee defines operational risk as "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events".

To deal with such a variety of possible risks, the committee proposed different approaches to calculate the net capital allocated to cover operational risk. Under the basic indicator approach, the institution is required to hold capital equal to a set percentage of its gross income as determined by the supervisory authorities. There is also the finer-grained standard approach, where the percentages are determined separately for each business line. Then, there is the advanced measurement approach (AMA), which comes in several variants: the internal measurement approach, the loss distribution approach (LDA), in which observed losses are modelled, and finally, the scorecard approach, based on 'scoring' the different business lines.

In all but the basic approach, the capital charge is calculated separately for each business line, and although the Basel Committee considered it only belatedly, the business of asset management – and therefore the fund valuation function – is covered by the proposed regulations.

And whether the goal is to get ready for Basel II, or simply manage the business better by taking a more rigorous approach to risk, the question of scale arises straight away. Should the problem be addressed with separation according to a typology of risks, or, given the dearth of loss data, should it be quantified on an overall basis?

The large number of outside players in the valuation process, with consequent multiplication of potential sources of error, strengthens the case for an approach that measures the risk in the process itself rather than the risk in the business line.

## The fund valuation process

Though at first sight, there is nothing complicated about valuation, it remains an imperfect science. In naive terms, valuing a fund involves no more than dividing the fund's net assets by the number of shares or units owned. However, the reality is far more complex (see figure 1). One of the difficulties, when working outside the context of large liquid markets, is to determine the true value of the securities in the portfolio. For example, for private-sector bonds, the officially quoted price may differ significantly from the actuarial value. Another difficulty arises from the time period between publication of the market value and receipt of the information needed to certify that value. For example, for a trade in a foreign security, it takes around four days to receive final confirmation from the custodian.

Valuation also involves many participants that must communicate faultlessly with each other: the fund sponsor, the centraliser, the management company, the depository, the custodian, the administration agent and the accounting manager or valuer. As shown in figure 2, these players send each other information not only to obtain values but also to check those values. So given the diverse nature of these exchanges – and the fact that an error can propagate through the circuit – the valuer's risk cannot be addressed in isolation from the other participants' risks.

The information exchanged gives rise to a systematic verification on the part of the valuer, which has an arsenal of checks and balances at its disposal. These checks are made both before and after the valuation and throughout the process of communicating the net asset value, with the emphasis on the more significant risks.

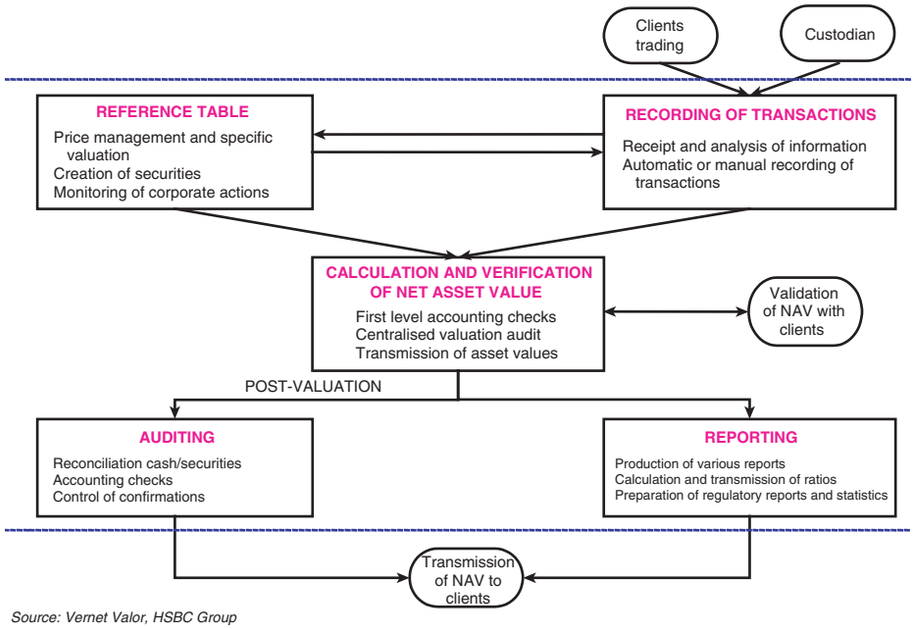
These crosschecks are buttressed by a systematic examination of the problems encountered in the past, the experience of which is reflected in the implementation of specific controls. In practice, there could be hundreds of specific controls, involving checks such as verification that trades were made at prices within reported bid-offer spreads and regular auditing of management fees, for example.

## Op risk associated with valuation

These checks and balances allow the fund valuation business to almost entirely eliminate operational risk losses. Most errors in the chain are detected before they cause any actual losses. But when losses do occur, the valuer's liability often has to be established on a case-by-case basis. A number of questions naturally arise – must net asset value be accurate or merely true to the input data? Is the valuer bound by a best-efforts obligation or an absolute obligation?

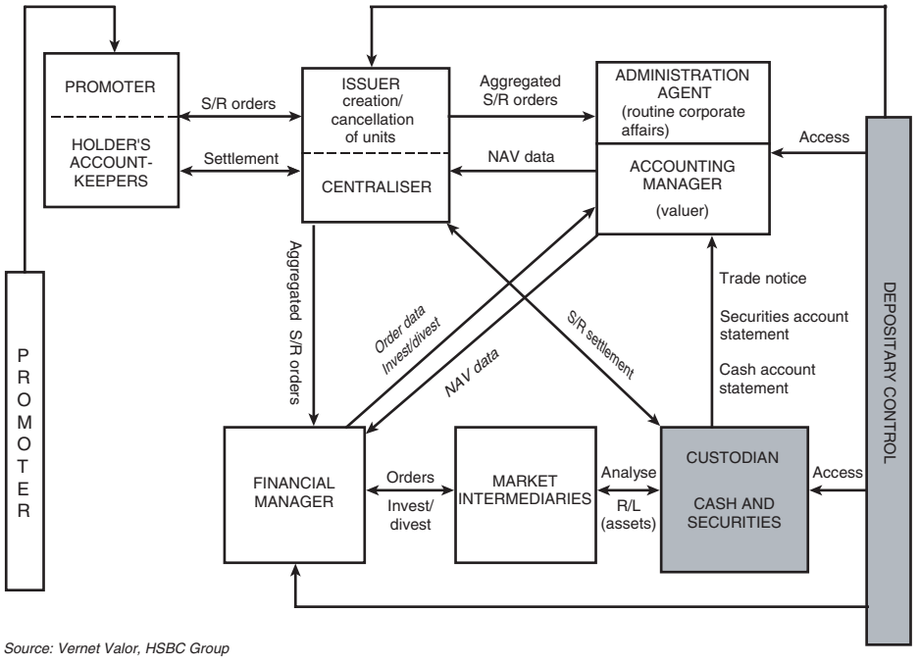
How much responsibility does the valuer bear, and at what price? The operational risk attached to the calculation of a fund's net asset value seems small for the company performing the valuation. The valuer's battery of checks and balances may miss errors, and these may be evidence of a fault in the larger process. It follows that the fund valuation business is subject more to an 'operational threat' than to an operational risk. The threat would be to fail to catch a very large error that has slipped by all the checks and balances and which could endanger the firm. The issue is therefore to quantify this risk/threat and protect against it.

## 1. Fund valuation process




*Source: Vernet Valor, HSBC Group*

## 2. Information circuits




*Source: Vernet Valor, HSBC Group*

### Building a database

To quantify the risk/threat of a very large error, it is necessary to build a database of actual losses so that past events can be studied. This is also a necessary condition for going beyond the basic approach of allocating net capital for regulatory purposes. Indeed, Basel II specifies that banks wishing to use the advanced approaches – and thereby benefit from a reduction in their capital charge – must meet certain conditions. One of these conditions, for the AMA method, is to ultimately have a loss database extending over at least five years. Only institutions that can prove the quality of their operational risk measurement and management systems to the regulator can hope to benefit from a reduction in their capital adequacy requirements. In asset management, as in other business lines, building a loss database is also a prerequisite for any mathematical modelling process.

### Modelling operational risk

The approach developed at CCF has three elements: a statistical model of the losses due to operational risk, the capital allocated to cover this risk, and the level of risk exposure chosen by the valuation company.

For modelling purposes, the idea is similar to the Basel Committee's proposed method based on the statistical distribution of losses – the loss distribution approach. Losses are modelled by a random process that takes account of both frequency and severity. The parameters of this process are estimated from the historical error data.

Just as banks take credit risk into consideration when setting lending rates, a valuation company could include compensation for bearing op risk when billing services to clients. The idea is not to build recognition of op risk into the capital allocation alone, but to implement an insurance-like system, with an allocation of capital at the beginning of the year – a risk provision – combined with premiums paid by clients via billing for the cost of risk. The initial capital then increases with each premium received and decreases with each loss due to an operational incident (see figure 3).

The risk borne by the valuation company is then measured by the probability of losing the initial capital endowment. The objective is to find a mathematical relation between the three main variables considered: the initial capital, the proba-

bility of losing that capital, and the premiums paid by the clients. The goal is to determine how much capital to allocate and how much to bill the clients for a given level of risk.

### Loss process approach

Once the main variables have been defined and modelled, the next step in the LDA method is to approximate the aggregate loss distribution via simulations – using a Monte Carlo method, typically – so that the capital requirement can be determined. At CCF, we replaced this step with the LPA. Effectively, we use the Cramér-Lundberg model, which is based on composite Poisson processes. In this way, a premium is introduced.

Having posited the form of the probability distributions for our data modelling, we obtain a formula that gives the probability of never losing all the allocated capital as a function of the level of the premium and the initial capital. Thus, for a given level of risk, it is possible to determine all the capital/premium pairs that achieve this result. Similarly, for a given choice of initial capital and a specified probability of never losing any money – instead of never losing just the initial capital – we can use the model to obtain the amount of the premium needed to cover operational risk. Conservatively, the underlying time horizon of our model is infinite, whereas usually one would reckon only for the year ahead – the premiums are expressed on an annual basis. The idea is to consider the start of each year as the beginning of a new infinite period and re-apply the model – after adjusting the parameters, of course, and also after increasing or decreasing the provisions based on what happened in the previous period. As with the LDA method, it's possible to perform simulations and obtain results over one year – the horizon recommended in Basel II for the advanced approaches.

Examples of the results obtained after calibrating the model on the historical error database compiled at CCF are presented in table A. For example, for initial capital of €750,000 (0.002206% of the fund assets administered by CCF's fund valuation company, Vernet Valor) and a 99.9% probability of keeping this capital intact, we obtain a premium of less than 0.5 basis points.

### Other uses

As mentioned, the model has an additional 'quality-oriented' use in terms of managing and benchmarking valuation companies. The quality of a valuation company in terms of risk management and effectiveness of controls can easily be characterised using this framework. Clients can use the resulting benchmark in a comparative analysis of valuation companies.

Valuation company managers could also use this new quality index to assess how well their firm is managing its operational risk, and prompt them to take preventive measures when needed. This brings us back to the original objective of controlling operational risk – optimisation of the reaction time to events that occur infrequently but generate immense losses.

So, based on a statistical description of the dates of occurrence and the amplitude of operational losses, the model outlined here explicitly gives the probability of not losing a given initial capital endowment as a function of the amount of that endowment and the annual premium. Similarly, for a given level of protection against operational risk chosen by the valuation company's top management and a given billing rate chosen by the sales department, the model indicates the amount that should be set aside in provisions to protect the company. This type of framework is a useful complement to the setting up of the database when the goal is to improve the quality of the overall process. □

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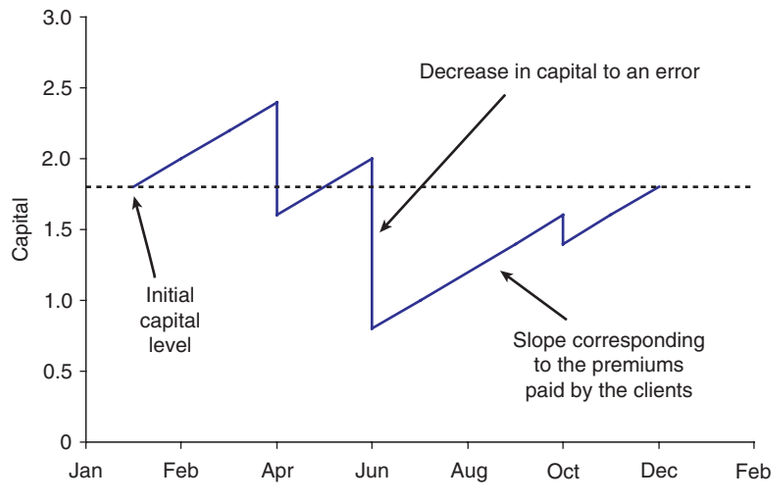
**3. Capital variation**




Source: CCF, HSBC Group

**A. Capital, premium and risk (%)**

Initial capital set aside at the beginning of the year and expressed as a percentage of the total assets managed by the valuation company

| Coverage \ Capital | 0.000147 | 0.000735 | 0.001471 | 0.002206 | 0.002941 | 0.003676 | 0.004412 |
|---|---|---|---|---|---|---|---|
| 1 | 0.00203 | 0.00261 | 0.00334 | 0.00408 | 0.00481 | 0.00555 | 0.00628 |
| 50 | 0.00262 | 0.00275 | 0.00342 | 0.00413 | 0.00485 | 0.00558 | 0.00631 |
| 75 | 0.00358 | 0.00292 | 0.00350 | 0.00418 | 0.00489 | 0.00561 | 0.00633 |
| 90 | 0.00597 | 0.00319 | 0.00361 | 0.00425 | 0.00494 | 0.00565 | 0.00637 |
| 95 | 0.00957 | 0.00343 | 0.00371 | 0.00431 | 0.00499 | 0.00569 | 0.00640 |
| 99 | 0.03668 | 0.00422 | 0.00397 | 0.00446 | 0.00509 | 0.00577 | 0.00646 |
| 99.5 | 0.07020 | 0.00470 | 0.00410 | 0.00454 | 0.00514 | 0.00580 | 0.00649 |
| 99.9 | 0.33809 | 0.00645 | 0.00446 | 0.00472 | 0.00527 | 0.00590 | 0.00657 |

Probability of keeping the initial capital intact

The figures calculated in the coverage section are the premium needed to cover operational risk given the chosen parameter values

Source: CCF, HSBC Group