

**Operational Risk**

**By**

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# Operational Risk

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## I. What is Operational Risk?

To begin with, operational risk is extremely hard to define. In the Consultative Document issued by the Basel Committee on Banking Supervision, in January 2001, in the Document on Operational Risk, in Section A, II, paragraph 6, the Committee defined it as "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events". They, then, immediately noted that "Strategic and reputational risk is not included in this definition", whatever 'strategic' risk may be.

There are, however, almost as many differing definitions of 'operational risk' as there are papers on this particular subject; one such definition, for example, is "all risks excluding credit and market risks". For example, in the paper by R. Avery and P. Milton, 'Insurers to the Rescue?', in the paper on Operational Risk, published by the Risk Management Unit, (Informa Business Publishing), on page 61, it was written that,

"But it was clear from the committee's survey of 30 major international banks that there are still as many definitions of operational risk as there are banks.

`At present, there is no agreed or universal definition of operational risk. Many banks have defined operational risk as any risk not categorised as market or credit risk and some have defined it as the risk of loss arising from various types of human or technical error. Many respondent banks associate operational risk with settlement or payments risk and business interruption, administrative and legal risks. Several types of events (settlement, collateral and netting risks) are seen by some banks as not necessarily classifiable as operational risk and may contain elements of more than one risk. All banks see some form of link between credit, market and operational risk. In particular, an operational problem with a business transaction (for example, a settlement fail) could create market or credit risk, some banks view it as a separate risk category with its own discrete risk factors,' stated the report."

Not only is operational risk extraordinarily hard to define, it is equally particularly hard to measure, either in terms of (the probability of) events of such risks occurring, or the resultant losses from such events. The likely ex ante probability of operational risk can sometimes be measured, though in such cases the risks are usually not vital, normally involving relatively frequent but quite small scale problems and losses, for example arising from credit card fraud, and from administrative errors in the trading process, excluding fraud and other criminal activities. On this subject see the article by T. Pagett, J.C. Karow and J. Duncan, `Top Down or Bottom Up?, Operational Risk, (op. cit.), pages 9-23.

Whereas the regular, but quite small, losses arising from credit card fraud and administrative errors in the trading process are capable of quantification, the cases that everybody remembers, relating to operational risk, usually involve fraud and criminal activity, and/or mispricing, whether intentional or not, (though the important cases in such instances have often been intentional and covert). For example, the key operational losses, selected from Euromoney, June 1999, included the following:-

<b>Date</b>	<b>Bank</b>	<b>Cause of loss</b>
August 1974	Herstatt	Strategic failure in FX
November 1985	Bank of New York	Payments crisis
December 1986	Morgan Grenfell	Guinness affair
April 1987	Merrill Lynch	Mortgages
May 1987	Citibank	Strategic failure in LDCs
May 1987	Various	Local authority swaps
April 1989	Chemical	Rogue trader
March 1990	Drexel Burnham Lambert	Strategic failure
March 1990	DG Bank	Failed repo trades
March 1991	Salomon	Bond auction scandal
March 1991	Nomura	Bribery scandal
April 1994	Merrill Lynch	Orange County
April 1994	Bankers Trust	Procter & Gamble/Gibson

November 1994	Kidder Peabody	Rogue trader
February 1995	Barings	Rogue trader
June 1995	Daiwa Bank	Rogue trader
September 1996	Deutsche Bank	Asset management fraud
February 1997	NatWest	Options mispricing
March 1997	Normura, Nikko, et al	Bribery scandal
September 1998	UBS	Failure at LTCM
October 1998	Bank of America	Problem at DE Shaw

Likewise M. Levine and D.G. Hoffman in their article on 'Enriching the Universe of Operational Risk Data: Getting Started on Risk Profiling', in Operational Risk, had as Exhibit C, on pages 37-39, their list of landmark operational loss cases, which is reproduced here as Appendix 1. Whereas we all tend to remember these dramatic cases of fraud, criminal activity, and speculation, their very rarity makes it quite difficult to provide accurate data bases, and assess probabilities of such events, and perhaps even more so of the subsequent losses, given those events. Admittedly there has been some attempt to do so, as reported in the previously noted article by Levine and Hoffman. However, the Basel Committee itself is quite sceptical about the present state of availability of adequate data bases for such purposes, for example see the following section in Annex 3 of the Consultative Document on operational risk, entitled

'Standardised Approach'.

"However, there are obvious sources for arriving at some idea as to how much operational risk is in each business line. In particular there are the currently available databases of operational losses provided by some consultants. These databases are biased, for instance to larger losses, to data that is publicly available, to regulatory regimes that encourage operational loss transparency, etc. Also, such databases cover loss experience from all types of financial firms and not just large internationally active banks. Another source is the internal loss data provided by our current sample of banks. However, this too is biased. The sample is small, the loss data imperfect in quality, often has a short time run, and is biased towards small operational losses. Finally, given the problems noted for both the above data sources, it would seem reasonable to use a reality check, based on supervisory perception of relative risks. Consequently, in this area, any analysis is bound to be very subjective."

Even when there are some, albeit insufficient, data bases on the likelihood and probability of such illegal and fraudulent acts, the data on the extent of losses, given such events, is equally, perhaps even more, insufficient. For example, in their Consultative Document on Operational Risk, in paragraphs 7 and 8, on Direct Versus Indirect Losses, the Committee wrote as follows:-

"7. As stated in its definition of operational risk, the Committee intends for the capital framework to shield institutions from both direct and certain indirect losses. At this stage, the Committee is unable to prescribe finally the scope of the charge in this respect. However, it is intended that the costs to fix an operational risk problem, payments to third parties and write downs generally would be included in calculating the loss incurred from the operational risk event. Furthermore, there may be other types of losses or events which should be reflected in the charge, such as near misses, latent losses or contingent losses. Further analysis is needed on whether and how to address these events/losses. The costs of improvement in controls, preventative action and quality assurance, and investment in new systems would not be included.

8. In practice, such distinctions are difficult as there is often a high degree of ambiguity inherent in the process of categorising losses and costs, which may result in omission or double counting problems. The Committee is cognisant of the difficulties in determining the scope of the charge and is seeking comment on how to better specify the loss types for inclusion in a more refined definition of operational risk. Further, it is likely that detailed guidance on loss categorisation and allocation of losses by risk type will need to be produced, to allow the development of more advanced approaches to operational risk, and the Committee is also seeking detailed comment in this respect."

In view of the lack of hard, quantitative data on the probability of events, of fraud and/or mispricing, and of the losses given such events, the approach towards the application of (regulatory) capital to operational risk needs, as a consequence, to be extremely broad brushed. The Basel Committee undertook a survey of what a number of large banks did. This follows the standard practice of financial regulators, when, in the absence of much theory, or evidence, the tendency is to 'go and ask what best practice banks do, and then get everyone to do the same'. The general answer

which the Committee got to this (relatively small) survey was that banks tended to apply 20 percent of their capital to meeting operational risk, always remembering that each bank probably defined such risks differently for its own purposes.

So the simplest way to apply a weighting for operational risk, in order to ensure that the capital applied for such purposes amounted to about 20 percent of overall capital, was to apply a single indicator, weighting gross income by a factor to reach a 20 percent level.

Nevertheless, it is obvious, and was clear to the Basel Committee, that differing kinds of business involved different degrees of potential operational risk. They have therefore sought to provide relative weightings on different business lines, in order to be able to distinguish between the risks of different kinds of financial activity. This is set out in Table 1 and page 21 of Annex 3 of the consultative document on operational risk, which is reproduced below:-



Table 1: Calculation of relative weightings of the business lines<sup>1</sup>

<b>Business Line</b>	<b>Range (%)</b>
Corporate Finance	8 - 12
Trading and Sales	15 - 23
Retail Banking	17 - 25
Commercial Banking	13 - 20
Payment and Settlement	12 - 18
Retail Brokerage	6 - 9
Asset Management	8 - 12
Total	80 - 120

The Basel Committee, however, hope that banks will be able to go beyond such externally applied weightings, and undertake some of the relevant calculations for themselves. Thus, in paragraph 32, they write that "In order to facilitate the process of supervisory validation, banks [will] supply their supervisors with the individual components of the expected loss calculation (i.e. EI, PE, LGE) instead of just the product EL. Based on this information, supervisors calculate EL [the expected loss] and then adjust for unexpected loss through the gamma term to achieve the desired soundness

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<sup>1</sup> Insurance has been excluded here. The reason for this is that presently there are doubts whether the sample banks included regulatory capital numbers for insurance companies within the group; especially as insurance is usually excluded from consolidated regulatory returns for banks. It is also intended that an agency services business line will exist in the final proposal. Clearly the ranges would change as a result of these modifications.

standard."

All this is set out in slightly more detail in the following section on Parameters, paragraphs 34 to 36, which are reproduced below:-

"34. The **exposure indicator (EI)** represents a proxy for the size of a particular business line's operational risk exposure. The Committee proposes to standardise EIs for business lines and loss types, while each bank would supply its own EI data. Supervisory prescribed EIs would allow for better comparability and consistency across banks, facilitate supervisory validation, and enhance transparency.

35. **Probability of loss event (PE)** represents the probability of occurrence of loss events, and **Loss given event (LGE)** represents the proportion of transaction or exposure that would be expensed as loss, given that event, PE could be expressed either in "number" or "value" term, as far as the definitions of EI, PE and LGE are consistent with each other. For instance, PE could be expressed as "the number of loss events / the number of transactions" and LGE parameters can be defined as "the average of (loss amount / transaction amount)". While it is proposed that the definitions of PE and LGE are determined and fixed by the Committee, these parameters are calculated and supplied by individual banks (subject to Committee guidance to ensure the integrity of the approach). A bank would use its own historical loss and exposure data, perhaps in combination with appropriate industry pooled data and public external data sources, so that PE and LGE would reflect each bank's own risk profile.

#### **Risk weight and gamma (scaling factor)**

36. The product of  $EI \cdot PE \cdot LGE$  produces an Expected Loss (EL) for each business line/risk type. The term  $\gamma$  represents a constant that is used to transform EL into risk or a capital charge, which is defined as the maximum amount of loss per a holding period within a certain confidence interval. The scale of  $\gamma$  will be determined and fixed by supervisors for each business line/loss type. In determining the specific figure of  $\gamma$  that will be applied across banks, the Committee plans to develop an industry wide operational loss distribution in

consultation with the industry, and use the ratio of EL to a high percentile of the loss distribution (e.g. 99%)."

As can be seen from the above, the procedures for assessing the capital requirements to meet operational risk are building quite a complex procedure on top of a database which is, by comparison, notably shaky and fragile.

## II. A Critique of the Basel Proposals for Operational Capital

Let us start with a fundamental question, which is what is the locus for Basel to require regulatory capital for operational risk in the first place?

Let us remind ourselves on the basic reasons for regulation. These are:-

(i) The control of monopoly prices, e.g. by utilities; this is clearly not relevant here.

(ii) Customer protection, and the conduct of business rules. This might be thought to be relevant, in so far as mispricing clearly adversely affects customers, and the event and consequences of such mispricing represents a major element in operational risk. But, requiring specific additional capital for operational risk is not likely to reduce the event of mispricing. Indeed, it may actually lead to incentives whereby mispricing becomes more common. This may be so because the additional requirement for capital will raise pressures on the intermediaries subjected to such constraints to maintain the rate of return on capital by undertaking riskier, or less ethically acceptable, activities; including under this heading mispricing itself. Consequently, a measure

taken in order to limit the adverse effects of an event, may result in incentives which would increase the number of such events themselves. Such a response is not atypical of developments in this field, see, for example, J. Adam's book on Risk.

(iii) The third main rationale for regulation, which is particularly important in the case of banking, and to a lesser extent in other financial intermediaries, is the potential onset of Systemic Risk. But, such systemic risk does depend to a very large extent on the potentiality of contagion, whereby failure in one institution sets off runs on, or market pressures on, other financial intermediaries. But, in the case of operational risk, this is not normally relevant, unlike the cases of credit and market risk, in which latter instances contagion is an ever-present danger. In the case of operational risk, criminal activity, and fraud, occurs idiosyncratically. When Leeson undertook his fraudulent and speculative positions in Barings, and they came crashing down, there was no possible way in which anyone could assess the likelihood of a similar person, or similar set of positions, in any of the other banks or financial intermediaries around the world. Consequently there was no possibility for people to run from institutions likely to be similarly affected, because no one knew whether or which such

similar institutions might be.

In Barings as in other such cases, the loss falls directly on equity holders, management and bond holders. Even in the case of Barings, which was a quite extreme example, there was no resultant loss on deposit holders. So the loss, in almost all cases, falls directly on those who should be most responsible.

It is not at all clear why there are likely to be any externalities in such circumstances. If there are no such externalities, then it remains appropriate for the equity holders and management to decide for themselves what the appropriate level of capital to hold against such losses might be. What then is the call for any regulation of operational risk at all?

The main rationale appears to be that low capital ratios enhance the fragility of individual institutions within the system. Even if the impact of fraud is primarily idiosyncratic, the failure of any one very large institution can have market effects on a wider scale, sometimes far removed; for example, the main contagious impact of the Barings crisis was actually felt in the Osaka Futures Market.

Moreover, if capital ratios decline, then the fragility of the system as a whole may increase. In the 'more advanced' credit and market risk management arrangements in the latest

Basel Capital Adequacy Proposals, there is a carrot, or incentive, to the banks to move towards such more sophisticated measures in the sense that these should lead them on average to have lower required capital ratios. Indeed this is the intention. But, if the 'better' banks are to be encouraged to move towards the more sophisticated measures by the prospect of lower capital ratios, then this would reduce average capital ratios across the system as a whole.

But the authorities do not want the system as a whole to have such lower capital ratios. So, the new emphasis on 'operational risk' is, partly, just a smoke-screen for a cumulative add-on factor, to offset the reduction that would otherwise occur from the move towards more sophisticated measurement of the other kinds of risk.

To some extent, the Basel Committee explicitly recognises this, as set out in paragraph 2 of the section on Operational Risk, reported below:-

"2. Under the 1988 Accord, the Committee recognises that the capital buffer related to credit risk implicitly covers other risks. The broad brush approach in the 1988 Accord delivered an overall cushion of capital for both the measured risks (credit and market) and other (unmeasured) banking risks. To the extent that the new

requirements for measured risks are a closer approximation to the actual level of those risks (as a result of the proposed changes to the credit risk calculation) less of a buffer will exist for other risks.

It should also be noted that banks themselves typically hold capital well in excess of the current regulatory minimum and that some are already allocating economic capital for other risks."

While I have some sympathy with the view that there is a need for an add-on factor, to offset the otherwise likely effect of the sophisticated measures in reducing overall capital holdings, it might have been better to be more straightforward about that. Moreover, if it is to be simply an add-on effect, and particularly in the context of an insufficient database, the more complex procedures for estimating such operational risk as set out in Annex 3, seem to add unnecessary complexity, where greater simplicity would have been a virtue.

There is also a severe problem arising, to wit that of competitive equality between those subject, i.e. banks, to the Basel Committee proposals, and those not so subject. For example, asset management car that osj□-451taktterwis the nex,



capital requirement of, say, 8 to 12 percent, as indicated in Table 1 in Annex 3 of the document on Operational Risk, then they will shortly come under severe competitive pressures, as contrasted with asset management institutions who are not subject to similar requirements. Whether or not it is intended, the effects of this new regulatory proposal, could well be to force the segmentation of various kinds of non-core financial businesses out of banks, into non-banks.

Next, there is the perennial question whether the needs to deal with operational problems have to be met by external, imposed, regulation, or could equally well be met by private sector market processes. Again, this possibility was raised in the booklet on Operational Risk, notable in the chapter by R. Avery and P. Milton, both of Aon, entitled 'Insurers to the Rescue'. In addition to the question of possible market insurance, there is also the issue of whether an operational risk derivative market could be established, and this particular possibility was raised, in the same booklet, by L. Schmidt-Ott, of Swiss Re, in his article on 'An Appeal for An Operational Risk Derivatives Market'.

Indeed, Aon have already developed, along with Swiss Re, an instrument labelled FIORI (Financial Institutions Operational Risk Insurance), op. cit., pages 65 and 66, whose coverage is reported below:-

"The policy categorises operational risk under five core headings attempting to give buyers horizontal coverage, these are:

Physical Asset Risk

Risk that damage or loss of physical assets will impact the ongoing business environment. Standard property coverage against fire and damage to buildings fall under this category.

Technology Risk

For many banks this is counted as a fourth risk type alongside credit, market and operational. FIORI encompasses this category which includes risk of loss resulting from systems unavailability, poor data quality, system errors or software problems.

Relationship Risk

This is classified as risk of loss resulting from relationship issues such as sales practices, customer problems, unsuitable relationships and the like. A good example of this risk is the huge number of claims brought against UK life and pensions companies in recent years for the sales of inappropriate pensions to individuals.

People Risk

The risk that business performance may be impacted by improper personnel policies, motivational issues which may result in actions such as sexual harassment or fraud.

External Fraud

The risk of loss resulting from external fraud."

However, note that while FIORI covers the adverse effects of external fraud, there is no cover for internal fraud, and there is no mention of the possibility of the losses arising from intentional mispricing. Moreover, as is interminably

repeated in issues such as this, insurance tends to lead to moral hazard, adverse incentives, unless such insurance can be exactly and correctly appropriately priced. Given the absence of databases, and the very considerable difficulty of observing exactly how well management is controlling for operational risk, it is difficult to see how such pricing could be undertaken. Indeed, there is a problem whether many of these risk events are observable, and if observed, whether the losses arising are capable of being appropriately measured. In my own view, the idea that operational risk could be effectively handled by private sector insurance and market measures, seems at this juncture a bit far-fetched.

Perhaps a key issue is to devise a better and more encompassing set of incentives to detect, control and limit fraud. This subject has been addressed in the article on 'Securities Fraud' by Instefjord, Perraudin and Jackson, in Economic Policy (1998). Their conclusions, which I would endorse, are as follows:-

- "1. Regulators should encourage firms to improve their control environments. This facilitates the efforts of managers to monitor their subordinates and prevents firms from declining into equilibria in which irregularities are pervasive.
2. Regulators should adopt ex post penalty structures which allow them to penalise managers at different levels in the hierarchy. Few regulators do so at present.
3. Simply imposing heavy penalties on dealers will not necessarily reduce fraud. In our simple models, strong substitution effects are present in that fines imposed on dealers lead to offsetting reductions in monitoring, leaving the prevalence of

fraud unaffected. Incentives for those who monitor are very important.

4. Firms should reward managers who discover actual or potential control lapses and avoid (to the extent that this is possible) too close an alignment between the pay of managers and profits reported by the dealers they manage."

### III. Conclusions

- (1) There is both little locus or sensible basis for imposing a specific operational risk capital requirement.
- (2) If the underlying purpose is to raise overall system capital ratios, which is arguable, then be honest about it and just have a simple add-on, without all the bureaucratic paraphernalia.
- (3) If you seriously want to reduce operational risk (especially fraud), control the incentive (pay) structure, not the capital ratio. A nettle that most regulators (except NZ) dare not touch?
- (4) Insurance, plus derivatives, is likely only to play a

limited role for the foreseeable future.

Appendix 1

Bank of Credit & Commerce

**Event:** In 1991, BCCI collapsed in one of the world's largest banking fraud cases of the century.

**Detail:** The BCCI treasury function played a key role in bringing the Institution down, as it used a series of cover up techniques to conceal its speculative losses from the auditors and regulators for over 3 years to the tune of over \$1.3bn.

**Key Issues:** Lax supervision, auditing and accounting.

Bankers Trust

**Event:** Bankers Trust lost \$150m related to a dispute over interest rate swap losses in relationship with Procter & Gamble (P&G).

**Detail:** In 1996 BT was compelled to settle charges that it misrepresented derivatives risk.

**Key allegations/Issues:** Sales practices, breach of contract, account assignment process, misrepresentation, derivatives risk.

Barings

**Event:** In 1995, located in their Singapore office, Nick Leeson, a 28-yr old employee lost £860m in trading on the future of Japanese stock prices forcing the bank into insolvency. The company was rescued due to infusion of \$1bn by ING.

**Detail:** Excessive speculation and lack of controls (ie, lack of traditional segregation of duties) provided the circumstances. Losses can be traced back to the earthquake in Kobe, Japan. Fears over the costs of repairing the earthquake damage forced the Nikkei 225 down more than 8% in five days, plunging Barings'

offshore futures contracts deep into the red.

**Key Issues:** Lack of segregation of duties, lack of dual controls,, failure to question excess profitability.

Metallgesellschaft AG

**Event:** In 1993, Metallgesellschaft AG revealed that its energy group was responsible for approximately \$1.5bn of losses.

**Detail:** Metallgesellschaft's losses were mainly due to a failure of controls and cash-flow problems resulting from large oil forward contracts it had written.

**Key issues:** Improper supervision, lack of transparency in control structures, trading strategies risk, inadequate management practices.

Morgan Grenfell

**Event:** In April 1997 Deutsche Morgan Grenfell was fined a record £2m, the largest penalty ever imposed on a British financial institution, for its failure to control Peter Young after he was alleged to have diverted over £100m into Sol-vex.

**Detail:** Regulators revealed that at least one DMG director knew about Young's rogue activities some five months before, adding, "The management of Morgan Grenfell failed to control the operations and ignored repeated warnings with severe financial results."

**Key allegations:** Unauthorised actions, negligence, breach of regulatory policy.

NatWest

**Event:** In 1997, Natwest announced a net charge of £77m as a result of losses and mis-pricing in its London interest rate options business that went undiscovered for some time.

**Detail:** Concealment from operations and internal

controls as well as falsely adjusted volatilities input into pricing in order to increase the value of relevant books. There were also unauthorised transfers of value between options books to conceal losses and transfer false profits. The independent price-checking regime for the interest rate options area was found not to have had sufficient procedures for checking options pricing.

**Key issues:** Concealment of evidence, model risk, falsifying records, accounting and auditing process, lack of checks and balances.

#### Kidder Peabody

**Event:** In 1993, Joseph Jett, then in charge of the firm's government securities desk, allegedly manipulated trading in `strips' (separate trading of registered interest and principal of securities and `recons' (reconstituted bonds) so as to create fictitious profits for Kidder of approximately \$350m.

**Detail:** Management failed to create an environment in which extreme profits would be questioned. Instead employees were not willing to ask tough questions when above market returns were being earned. Kidder's management, audit and accounting systems failed to detect the scheme.

**Key allegations/Issues:** Lax supervision, poor judgement, weak accounting and audit controls - not focused on excess profit, lax quality control.

#### Prudential

**Event:** A 2bn class-action settlement concerning contentions that agents for the Prudential Insurance Company of America misled policyholders in a 13-year period from 1982-1995.

**Detail:** The settlement covered more than 8 million policyholders who may have been misled into buying devalued insurance policies. Investigators concluded that Prudential agents routinely lied to prospective policyholders to make sales.



**Key allegations:** Fraudulent sales practices,  
misrepresentation.

### **Bibliography**

Avery, R. and P. Milton, (Aon), 2001, 'Insurers to the Rescue', in Operational Risk, pp 61-69.

Basel Committee on Banking Supervision, 2001, The New Basel Capital Accord. Bank for International Settlements: Basel, January.

Basel Committee on Banking Supervision, 2001, Consultative Document: Operational Risk. Bank for International Settlements: Basel, January.

Instefjord, N., P. Jackson and W. Perraudin, 1998, 'Securities Fraud', Economic Policy, 27, October, pp 587-623.

Levine, M. and D.G. Hoffman, (Operational Risk, Inc.), 2001, in Operational Risk, pp 25-39.

Pagett, T., Karow C. and J. Duncan, (Ernst and Young), 2001, in Operational Risk, pp 9-23.

Risk Management Unit, 2001, Operational Risk, Informa Business Publishing: London.

Schmidt-Ott, L., (Swiss Re New Markets), 2001, in Operational Risk, pp 55-59.

## Bibliography

Avery, R. and P. Milton, (Aon), 2001, 'Insurers to the Rescue', in Operational Risk, pp 61-69.

Basel Committee on Banking Supervision, 2001, The New Basel Capital Accord. Bank for International Settlements: Basel, January.

Basel Committee on Banking Supervision, 2001, Consultative Document: Operational Risk. Bank for International Settlements: Basel, January.

Instefjord, N., P. Jackson and W. Perraudin, 1998, 'Securities Fraud', Economic Policy, 27, October, pp 587-623.

Levine, M. and D.G. Hoffman, (Operational Risk, Inc.), 2001, in Operational Risk, pp 25-39.

Pagett, T., Karow C. and J. Duncan, (Ernst and Young), 2001, in Operational Risk, pp 9-23.

Risk Management Unit, 2001, Operational Risk, Informa Business Publishing: London.

Schmidt-Ott, L., (Swiss Re New Markets), 2001, in Operational Risk, pp 55-59.