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Basel II and Operational Risk - Overview of Key Concerns

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BASEL II AND OPERATIONAL RISK - OVERVIEW OF KEY CONCERNS

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EXECUTIVE SUMMARY

The requirement, for the first time, by national regulators following the Bank for International Settlements guidelines for financial institutions to provide for operational risk, as distinct from credit and market risk, is posing difficulties of definition, implementation, and strategic planning.

The three pillars of Basel II introduce new capital ratios, new supervisory procedures, and demand better disclosure to ensure effective market discipline in both the equity and debt markets. This will affect product development, investment and asset mix, as well as requiring the rapid development of new risk rating models and techniques together with vastly expanded internal and external audit compliance routines.

The inclusion of the requirement to provide for operational risk in capital ratios appears to be causing the most problems for banks, which are the first “target” of regulatory compliance, insurance companies being the next. The very definition of operational risk, delineating it from credit risk, choosing from the three suggested approaches is some very basic problems in a choice matrix.

However the comprehensive enterprise-wide frameworks that are required, the need to conduct both qualitative and quantitative analysis, the problems of collecting data on which to base probability estimates, the fact that operational risk can vary dramatically across business units within a financial institution, let alone the difficulties of explaining and reporting operational risk both to internal management who will take the ultimate responsibility for signing off, and to the market – these issues are causing regulators and regulatees to demand more time to consider both strategic and implementation problems.

This paper, before embarking on definition and implementation issues, will first take a step back and consider the fundamental question of why banks fail – is it due to operational risk and if not, what will providing for operational risk achieve? Will the requirement make the systemic goals of stability and safety more achievable?

A second key question is, will the requirement to provide capital for operational risk over and above credit risk be an efficient or inefficient solution on a macro level. Many claim that additional capital will not assist a bank if fundamental management flaws exist. Moreover, if the operational risk requirement causes banks to increase pricing of loans and other products and services, and/or restrict credit due to difficulties in raising new capital, this can distort allocative, dynamic, and operational efficiency levels of the financial system.

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The defence of the inclusion of operational risk in the three Basel Accord Pillars, can only be that in forcing financial institutions to consider losses resulting from operational risk failures, better internal and external controls will result. An increased focus on and scrutiny of risk throughout a financial institution by both regulators and the market, should drive better risk management practices. The application of Basel II will create a market demand for information on operating risk coping strategies.

To summarise, the strengths or benefits of introducing operational risk into the regulatory equation may be the pressure on banks to improve strategic decision making and capital allocation, such as considering new fundraising techniques in order to compete for capital globally, forcing new governance procedures by emphasising the importance of managing public image and confidence, precipitating dramatic improvements in data management and technology which will enhance the precision of risk quantification. In addition Basel II will institutionalise greater data disclosure requirements both to the bank supervisors, creditors and shareholders, the assumption being that better regulatory reporting will promote greater systemic stability.

The Basel II requirements also embody incentives to strive for advanced methods of assessment for both credit and operational risk, in terms of a potential reduction of capital requirements, the possibility of integrating regulatory capital with capital management, and the greater sensitivity of regulatory capital to the risks banks face.

To conclude, if these benefits will materialise, then why is there such a diversity of views amongst regulators, and amongst banks as to implementation, particularly when consistency of regulatory application across jurisdictions, especially for those operating across many countries, is key objective of Basel II.

A brief overview of current systems and software approaches to operational risk will highlight this diversity, which may be a strength, not a weakness. However, what emerges from this overview of implementation problems are three key concerns, which have not yet been adequately answered:

1. How to define operational risk?
2. How to quantify operational risk in a context that is meaningful for the various types of financial institutions, which differ markedly in size, strategic position, function, market penetration? and
3. How much will it cost to make an ongoing commitment of both personnel and monetary resources extending way beyond the 2006 deadline in order to operationalise the requirements, which may distract management from the return side of strategic goals, enforcing a preoccupation with risk minimisation?

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BIOGRAPHY OF PRESENTER

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She uses these skills to advise governments on the design of financial systems in order to prevent regulatory failure and promote economic growth, as well as advise on infrastructure development through public private partnerships. Most recent assignments include a three day course on foreign exchange management and deregulation for 30 officials from the People's Bank of China and the design of a course in Public Finance for the University of Papua New Guinea. She has twice been a guest of the Chinese Government at APEC conferences and was the key speaker at a seminar organised by the Indonesian Chamber of Commerce in Jakarta in 2002.

Her skills in the corporate arena involve advice and training in the area of forensic accounting and corporate financial analysis. Positions held include a Senior Lectureship at the University of Technology (1991-present), Managing Director of Public Private Sector Partnerships Pty. Ltd. (current), Director of D.C. Gardner PLC (1987-1990), Consultant to the NSW Corporate Affairs Commission (1987 - 1990), Manager, Chase-NBA Group Ltd. (1976-1979).

1.0 Do Banks Fail because of Operational Risk?

1.1 Common Causes of Bank Failure

Since the establishment of the first bank in Italy, Monte de Pashi di Sienna in 1472, banks have been regarded as the safe repository of savings, as well as sources of incredible wealth and power. The English merchant bank Barings Brothers was considered to be a power to the rival Russian and Hapsburg Empire when they financed the Louisiana Purchase in 1890. In the 1960's and 1970's the major US and other international banks took on the task of recycling OPEC countries' wealth to finance the development of the booming economies of Latin America. Consequently, correspondent banking and interbank dealing was considered a virtually riskless venture and the idea of evaluating banks' creditworthiness was not even conceived of

With the collapse of Bankhaus Herstatt in 1974, and the foreign exchange losses suffered by a host of foreign banks as a result, together with the experience of too rapid liberalisation in the eighties and globalisation in the nineties, regulators have re-emphasised not only the need to evaluate creditworthiness of financial institutions, their commercial loan portfolios, and country risk exposure, but also the need to prevent and target fraud.

Causes of bank crises range from *lack of investor and depositor confidence* precipitated by perception of *deterioration in asset quality*. The latter is most commonly caused by excessive growth into overheated markets with failure to spread risks. *Excessive industry or country risk concentration, and intergroup lending*, all result from *lack of credit control*, sound lending policies and internal control procedures, checked upon by external auditors and the central bank supervisors.

Apart from asset quality, *large diversifications* into new areas of business, where the institution lacks expertise, are reasons that financial institutions as well as corporates get into difficulties. The risks in *overtrading* in banks, where either the foreign exchange positions are not controlled, or the option writing not fully appreciated is enormous, and spectacular losses have been made by banks in these areas. Greater volatility in international foreign exchange, money markets, and stock markets will only exacerbate this situation.

Another classic failing of financial institutions is *liability mismanagement*. The finance house industry in the UK in the seventies and the Savings and Loans industry in the U.S.A. in the eighties experienced appalling losses when funding fixed rate assets with floating rate funds at times when interest rates were rising.

Within this framework of causes of bank crises, fraud is the most difficult for the bank analyst to predict. Gup (1995) advocates establishment of an appropriate framework for clearly structuring a financial institution, by allocation of responsibility to directors in deterring fraud and establishing a system of internal controls, auditing, examinations and security.

The Office of the Comptroller of the Currency (OCC) found that deficiencies within boards of directors contributed to insider abuse and fraud, to bank failures and to problem banks². **Prevention devolves around embodying the responsibilities of a bank's Board of Directors in criminal law, company law, and common law, the latter requiring actual convictions of negligence and failure to exercise duty of care.** It also requires prudential supervisors to prescribe what they consider to be an appropriate committee structure, prudent lending policies, lending authority, how loans should be reviewed, and what practices are deemed unsafe and unsound.

Due to these factors being deemed to be lacking in failed banks and in particular Asian Banks pre the Asian Crisis in 1998, the Bank for International Settlements quickly moved in 1998 to lay down principles of what they consider to be an appropriate structure for internal controls to prevent fraud,

² "Bank Failure: an Evaluation of the Factors Contribution to the Failure of National Banks", (Washington, Comptroller of the Currency, June 1988, pp. 5-7, 15-16.)

and to prevent the development of other factors which can lead to banking crises³. The lack of operation of those principles has been well documented by Professor Benton Gup in his book “Targeting Fraud”⁴. Two excellent examples of this are BCCI, which he renames as “The Bank of Crooks and Criminals” and the Banca Nazionale de Lavoro (BNL), which he calls “the largest bank fraud in history”.

In 1988 the Bank for International Settlements issued a document containing guidelines for banks to prevent money laundering⁵. This was a response to the scandal of the collapse of the Bank for Credit and Commerce International (BCCI), which a 1988 US Senate Subcommittee on Terrorism, Narcotics and International Operations described as one of the principal banks used for such purposes. BCCI had surreptitiously entered the US market and improperly taken over at least two other US banks. The BCCI collapse resulted in the loss of US\$4 billion (possibly equal to ten times that amount in today’s terms), of which part was from the Treasury funds of more than 30 countries and the funds of more than 1 million depositors around the world⁶.

It is interesting that Gup attributes the ability to start Bank of Credit and Commerce International (BCCI), which was used for laundering drug-corrupted monies to four factors – bank secrecy in Luxembourg and the Cayman Islands, loans from the Bank of America for equity from which BCCI derived international credibility, an unlimited source of deposits from oil profits, qualified individuals available as a result of nationalisation of banks in Pakistan. In fact regulatory black holes regarding confusion as to responsibility for supervision between host and parent country can largely explain BCCI, as it was seriously undercapitalised, which should have led to its exclusion from key financial centres. BNL can be explained by virtue of its ownership – it was State Owned.

The worst bank failures in many OECD countries can be attributed to lack of private market mechanisms as well as the quandary of how governments can supervise entities they own. All the State Owned Banks failed in Australia during the late eighties due to failure to control risks of all types at every level⁷.

However, vital questions remain –

- *How many of these bank failure are attributable to operational risk within the bank?*
- *Or are they due to operational risk externally, either in the key national or international regulatory model?*
- *What is the relationship between fraud, operational risk, and credit risk in terms of culture, management and policy, and bank failures?*

1.2 The Australian Experience

In the 1970s the Australian financial system was tightly controlled by a system of firm-based and industry-wide protective measures, plus prudential supervision comprising an enforcement mode, methods of auditing and sanctions.

The RBA, formed in 1959 to take over the central banking functions from the Commonwealth Bank of Australia due to perceived conflicts of interest, was the only regulator of banks, but by a 1974

³ Bank for International Settlements, “Framework for the Evaluation of Internal Control Systems” (Basle Committee on Banking Supervision, Basle, January, 1998: website: <http://www.bis.org/publ>); Bank for International Settlements, “Framework for Internal Control Systems in Banking Organisations” (Basle Committee on Banking Supervision, Basle, September, 1998: website: <http://www.bis.org/publ>).

⁴ Gup, B., ‘New Financial Architecture for the 21st Century’, (Quorum/Greenwood Books, November, 2000) ISBN 1-567200-341-8).

⁵ Bank for International Settlements, “Prevention of Criminal Use of the Banking System for the Purpose of Money-Laundering” (Basle Committee on Banking Supervision, Basle, December, 1988: website: <http://www.bis.org/publ>).

⁶ Gup, (1995) p.31.

⁷ ‘The Value of Privatisation: The Case of the State Bank of NSW’, in Economic Papers, March, 2001.

Act also had power to control non-bank financial institutions. Given the stage of economic development of Australia, this was an incorrectly designed regulatory model.

The powers of this 1974 Act, although passed by Parliament were never utilised until the effects of Australia's attempts to enter a globalised financial system became evident with a series of rapid systemic shocks during the transition from the eighties to the nineties.

These shocks were first felt in the late eighties in the weakest links of a chain, where prudential oversight had been omitted, partly due to the status of non-bank financial institutions. Some of these, such as building societies, were regulated by State governments. Not regulated at all were the 100%-Australian-bank-owned merchant banking or finance arms. Then we had regulatory black holes in the form of State-owned banks. Under the Constitution, only their owners, the State Governments, could regulate these as they engaged in intrastate rather than interstate trade.

The Currie taxonomy of regulatory models categorises the 1980s regulatory model as “Benign Big Gun, Weak Prudential, Strong Protective”⁸. This model was the worst to adopt when undergoing rapid liberalisation from a position of strong prudential supervision with strong protective measures such as credit controls on the amount, type, and category of lending, liquidity, lending, interest rate and foreign exchange controls, as well as ownership. Scandinavian economies made the same mistake in the late 1980s, replicated by the Asian Tiger economies during the 1990s.

Some examples of financial institutional ‘victims’ of the 1980s regulatory model (with many quietly concealed losses), are listed in the following table, in order of impact rather than order of magnitude or history:

Such fallout raised the risk levels in the financial system. The worst performing banks by 1992 in terms of bad and doubtful debts were the ANZ and Westpac. The collapse of entrepreneurial companies such as Qintex (Christopher Skase), Westmex (Russell Goward), Adelaide Steamships, Bond Corporation, L.J. Hooker, Girvan (see Trevor Sykes account of this in ‘Bold Riders’) was part and parcel of the entire systemic shock.

How many of the losses incurred in the nineties on the books of financial institutions were due to bad and doubtful debts resulting from a poor credit culture, credit management and credit analysis, or how many were due to operational risk factors, involves two problems in the new millennium for Australian banks. The first is to build an operational and credit risk database based on past events, which can clearly attribute losses to causes. The second is to be able to quantify, to estimate the likelihood of recurrence expressed in a probability distribution with a high degree of statistical significance. Section 2.4 will highlight difficulties posed by both these challenges, but the first hurdle is to understand what distinguishes operational risk from credit risk.

⁸ This taxonomy is described in **The Optimum Regulatory Model for the next Millennium - lessons from international comparisons and the Australian Asian experience** in Gup, B. (ed) New Financial Architecture for the 21st Century, (Quorum/Greenwood Books, November, 2000) ISBN 1-567200-341-8.

Table 1: Australian Financial Institutional Failures

SOME VICTIMS OF THE 1980s REGULATORY MODEL			
Organisation	Activity	Outcome	Comment
<i>The Farrow Group</i>	Building society and finance company	Rescued by the State of Victoria due to fears of systemic fallout, which bankrupted the State and brought down a Government.	Most building societies have now converted to banks, and finance companies are now mostly brand names under the direct control of their banking parent, following changes to the capital adequacy rules commencing in 1989
<i>Estate Mortgage</i>	A trust run by a funds management company	Still undecided <i>vis a vis</i> unit holders – legal action taken against the trustee	Owned by Burns Philp
<i>Spedley</i>	Official money market dealer	Receivership, liquidation, multiple legal actions	This type of organisation no longer exists
<i>The State Bank of Victoria</i>	Brought down by its merchant banking arm, Tricontinental	Sold off to the Commonwealth Bank of Australia	In an interesting twist legal action was brought against the Reserve Bank of Australia by the State of Victoria
<i>State Bank of South Australia</i> <i>State Bank of NSW</i> <i>Rural and Industries Bank of WA</i>		All have disappeared through privatisation which was necessitated by a portfolio of non performing loans which were equal to on book equity	These banks have been successful once government ownership was eliminated. Prior to that the huge losses across the state bank owned sector could be attributed to poor credit analysis, poor credit risk management and an incorrect credit culture.
<i>Partnership Pacific Ltd</i>	Westpac's wholly owned merchant bank	Non performing loans eventually totalled approximately A\$2.4 billion	Wholly owned merchant banks now virtually operate as generic entities, and are now supervised by the Australian Prudential Regulatory Authority.

1.3 Definitions of Operational Risk and Flaws

Operational Risk has been defined by Basel II as,

- The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events, with,
- Internationally active banks and banks with significant operational risk exposures are expected to use an approach appropriate for the risk profile and sophistication of the institution (discussed further in

Where can operational risk arise? Table 1 details sources of operational risk, which are at times hard to segmentalise – for instance factor 2, quality of human resources may be the principal cause

of all the other sources. Factor 3, unauthorized trading may be the result of factors 4 and 7 – transaction processing and management processes

Table I: Sources of Operational Risk

<u>1. Criminal-internal or external</u> Eg theft or fraud, collusion between bank staff and customer, collusion between staff on correspondent banking desks; money laundering.	<u>4. Transaction Processing</u> Eg. Misprocessing, poor documentation, erroneous data entry; recording front end fees in year in which loan is advanced boosting profits, rather than allocating it over life of loan	<u>7. Management Processes</u> Intentional or unintentional Eg. Interference with internal auditors; Flawed reporting to Directors so they either do not have the facts or cannot understand them; abolishing a skilled Credit Bureau; getting rid of a ‘second board’ or NEDs or consultant auditors employed by the Directors
<u>2. Human Resources</u> Eg failure to apply tests to determine aptitude, ethics, psychological flaws; patronage; non-arms length relationship between internal human resource staff and ‘head hunters’.	<u>5. Technology</u> Eg investment in software to replicate judgmental processes at a high level; out of date hardware; failure to tailor to requirements	<u>8. Sales practices</u> Eg false and misleading statements, bonuses related to quantity not quality; no training in correct code of practice and ethics – refer to website of the UK Financial Service Authority for such training courses
<u>3. Unauthorised activities</u> Eg foreign exchange trading; advancing loans without appropriate approvals/security	<u>6. External Environment</u> Eg economic downturn leads to cutback of back office staff	<u>9. Disaster</u> Eg Flood, power strikes, terrorist activities

At this point, it is helpful to consider the original management literature that first analysed operational risk in a manufacturing context, which suggested various measurement techniques⁹. This literature was based on refuting two assumptions:

1. That factors which cannot be measured cannot be controlled.
2. That quality cannot be measured so it cannot be controlled.

The second statement was soundly refuted by the total quality management movement that started in Japan in the middle of the twentieth century and then spread to the US manufacturing sector starting in the late 1970s. The problem is that there is no single measure of quality. Rather, it is reflected in consistent performance on a variety of eclectic measures, which were developed in a body of knowledge known as Statistical Process Control (SPC).

The essence of SPC is structured and disciplined sampling of the results of a process. Every process is subject to some variation due to common causes outside the control of those managing the process itself. It is management’s role to eliminate as many of these common causes of variation as

⁹ This is best exemplified by statistical process control (SPC) as pioneered by Walter Shewart and described in his 1931 book, entitled Economic Control of Quality of Manufactured Product.

possible. Still, some minimum variation will remain. If a process is ‘in statistical control’, it will exhibit results that fluctuate around a mean performance level (perhaps with some predictable trend in this mean). While these fluctuations may not be normally distributed, sampling based on the average of several results, often with samples as small as four or five, will produce a nearly normal distribution. SPC practitioners monitor such sample results consistently over time in the form of process control charts. They examine these charts for evidence of non-normal behaviour. The idea is to use such evidence as an early warning of something new within the process itself that needs to be addressed, or possibly a new external cause that requires senior management attention. SPC practitioners have developed several rules of thumb relative to process control charts that are deemed to be signals worthy of investigation. Some of these are obvious by inspection, but others are more subtle and are best screened by computers¹⁰.

One obvious signal is:

1. A single outlier beyond three standard deviations. If the process results are normally distributed, such events only occur once in 370 trials, so they are worthy of investigation in their own right.

Less obvious signals include:

- Two out of three consecutive points beyond two standard deviations in one direction.
- Four out of five points beyond one standard deviation in one direction.
- Eight or more points on one side of the mean (regardless of how far removed).
- Six or more points with a common trend (that is, five or more consecutive first differences of the same sign).
- Fourteen or more points that oscillate up and down. This may be related to change of shift or rotation of equipment. Often, sampling must be done carefully or this effect may be masked in the data.
- Eight or more points beyond one standard deviation in either direction. Avoiding the centre of the distribution may indicate a new and previously unrecognised source of volatility.
- Fifteen or more points within one standard deviation. Signals are not always bad news. An unexpected string of results within one standard deviation may indicate some favourable improvement in the control process that can be isolated and replicated elsewhere.

Types of operational risk¹¹

Operational risk is an amalgamation of many disparate risks. While there have been many attempts to define it positively, its primary definition remains a negative one – losses that are not related to either credit or market events. Such events include fraud, settlement errors, accounting, and modelling mistakes, lawsuits, natural disasters, IT breakdowns, and many other types of loss. The heterogeneous nature of operational risk is a key difficulty underlying many of the issues we describe further in this article.

In credit and market risk, there is some commonality among the risks in question – they form a natural grouping. For example, credit risk is typically extended via a consistent process; the issues of default likelihood, exposure measurement, and loss-given default are similar; and the resulting exposures are subject to common risks, such as the risk of an economic downturn. Likewise, market risks deriving from price fluctuations of financial assets have common properties so that they can normally be managed in a consistent way, and modelled with a common process.

Operational risk appears to be different -.

- *Do the risks mentioned above share significant elements in terms of economic behaviour?*

¹⁰ Refer to website baselalert.com

¹¹ Holmes (2003).

- *Are they managed in a consistent way or are the specialities significantly different?*
- *Is there any reason to believe the risk of a major legal event can be captured by the same model as settlement errors or an IT breakdown?*
- *Would losses in one area suggest a likely weakness in another?*

It is useful to categorise operational risk into two groups:

- **Low-frequency large-loss events ('major')**, for example, rogue trading, major lawsuits and natural disasters.
- **High-frequency small-loss events ('minor')**, for example, settlement errors and credit card fraud.

The primary challenge for a capital model is addressing the major events. These events can threaten the capital or even the solvency of the firm, as was seen in the Barings case. Minor events are a secondary challenge. Reducing these events may create efficiency savings but is unlikely to affect the risk of the bank materially.

The causes of major events can be complex. They often include human failure, organisational failure, and adverse external environmental factors, all acting in combination. It is easy to see that a modeller who tries to capture the risk from major events has a very difficult, even questionable task. He or she may be tempted to use the more regular data provided by minor events, but this raises major conceptual issues –

- *Does data collected on one type of risk have any real relevance to another type of risk?*
- *If you have significant processing losses, does that imply that you have a higher exposure to rogue trading or that your internet firewall is ineffective?*
- *The heterogeneous nature of operational risk makes it difficult to use even the limited data that is available.*

Mathematical models are used in market and credit risk management for decision-making purposes because they provide the user with information on the potential losses that can be incurred for a given portfolio of positions. There is a clear link between the generators of risk – interest rate, equity price sensitivities and money lent – and the potential financial impact on the firm. The links can subsequently be tested and proved to work.

What should qualify as a 'risk model'? A model is a mathematical representation of a real-life situation that should be realistic enough to provide a good understanding of the main elements of the situation in question. Features of good risk models include:

- *They capture the essential features of the situation in a plausible manner;*
- *They have predictive qualities that can be used for decision making; and*
- *Those predictions can be validated.*

At a minimum, a good risk model should enable you to judge whether bank A is riskier than bank B, and whether bank A's risk is increasing or decreasing over time. Market and credit risk models generally satisfy these requirements, even though there remains lively debate about the best approaches, implementation specifics and other features.

Operational risk models currently proposed do not appear to satisfy these requirements at present. Current models are typically descriptive and backward looking, with limited intuition about how key features could create a risk event. Holmes (2003) claims there is no model that has a convincing capability to rank interbank risk or bank risk over time, nor, most critically, is there any model that has been validated for the major events that are crucial for risk capital.

Typical operational risk models start with either a **self-assessment 'scorecard'** approach or a loss-data approach. The scorecard approach is inherently qualitative. It raises the question of whether scorecards are really models, or whether they are simply a formalisation of the discussions that already exist in banks about risk prioritisation. Holmes (2003) is sceptical that this approach would give reliable information about bank risk over time or rank the relative risk of two banks. There appears to be no conclusive evidence that these models work in practice and have predictive properties.

The loss-data approach (LDA) appears to be a more serious attempt at modelling this type of risk, and has many ‘scientific’ elements. These models typically collect losses down to a low dollar threshold then apply an ‘off-the-shelf’ distribution to fit the loss data. Patterns in the low-loss frequent observation area are – by virtue of the distribution – believed to affect the likelihood of a high-impact event.

In effect, the data and the distribution are the model. The model develops simply because of the addition of new loss events or a revision to the supposed distribution. There is no attempt to determine whether the risk or size of the portfolio has changed. This is analogous to trying to model credit risk using only past default losses, with no account taken of the size and riskiness of the current credit portfolio.

Fundamental challenges in measuring operational risk follow from flawed definitions. Many groups in industry, academia and the regulatory community are trying to produce OR models for the finance industry, approaching operational risk measurement in a similar way to market risk and credit risk, using loss-data style models as their primary tool. The success of this approach will rest on whether operational risk has similar properties to market and credit risk.

One characteristic of operational risk that illustrates the weakness of the analogy is that while market and credit risk are independent of the bank taking the risk, operational risk is inherent in and an attribute of the bank itself. For example, consider two banks with identical trading positions and loan portfolios with exactly the same customers. Their market and credit risk will be the same but their operational risks could be significantly different. This poses deep issues for the use of industry-pooled data.

Both credit and market risk exposures are typically explicit, and normally accepted because of a discrete trading decision. Indeed, often the risk-taking decision depends on the ability to measure the risk of a transaction relative to its expected profitability. Market and credit exposures are also subject to well-understood concepts of quantifiable size. **Credit risk exposures** can be measured as money lent, mark-to-market exposure, or potential exposure on a derivative. The risk of the positions can be estimated using credit ratings, market-based models and other tools. **Market risk positions** can be treated as principal amounts or decomposed into risk sensitivities and exposures. The risk of these positions can be quantified with scenarios, value-at-risk models, and so on.

In both market and credit risk there is a direct link to the driver of risk, the size of the position and the level of risk exposure. These risk models allow the user to predict the potential impact on the firm for different risk positions in various market environments.

In contrast, operational risk is normally an implicit event. It is accepted as part of being in business, rather than as part of any particular transaction. There is also no inherent operational risk ‘size’ in any transaction, system, or process that is easy to measure. For example,

- *How much rogue trader risk does a bank have?*
- *How much fraud risk?*
- *How much could a bank lose from implementing a new IT system?*
- *Has the risk grown since yesterday?*
- *For both market and credit risk, risk exposures can be identified easily and expressed quantitatively; the equivalent ‘position’ for operational risk is difficult to identify.*

A related issue is the issue of completeness of the portfolio of operational risk exposures. For both market risk and credit risk, modelling starts with a known portfolio of risks. Indeed, it is a fundamental test of a bank’s risk management systems and processes to ensure that there is complete risk capture. However, in operational risk modelling, the portfolio of risks is not available with any reasonable degree of certainty by any direct means. Even if a bank knows its processes and could ascertain the size of the risk in those processes, it is difficult to identify unknown risks or non-process type risks (for example, fraud risk or a new type of IT breakdown). As mentioned above, many major events are of this type – they are simply outside the bank’s normal set of understood risks (for example, the September 11 impact on trade processing capability in New York City).

The issue of completeness explains the weakness in proposed approaches to measuring operational risk that rely mainly on operational risk loss experience to infer a loss distribution. In essence, these quantification approaches effectively try to imply the ‘portfolio’ of possible operational risk loss events from historic loss events. Imagine taking this approach to credit risk modelling, that is, ‘deducing’ the loan portfolio from historic defaults (experienced both at the bank in question and in the rest of the industry) instead of obtaining it from the firm’s books and records – this would certainly not be regarded as an acceptable modelling approach for effective risk management.

It is important to realise that this lack of knowledge about the portfolio of possible operational risk loss events is not a technical modelling challenge; rather, it is an inherent characteristic of operational risk.

The third important issue that affects the ability to effectively measure operational risk is context dependency. This describes whether the size or likelihood of an incident varies in different situations. It is important in modelling because it determines how relevant your data is to the current problem. For example, an analysis of transportation accidents over the past century would clearly contain data that had lost relevance due to different modes of transport, changing infrastructure, better communications, etc. For example, consider the following questions: are your businesses, people or processing systems similar to 10 years ago (for example, many banks have merged and/or materially changed their systems and processes); are the threats to those systems similar to 10 years ago (for example, did firms worry about internet virus attacks in 1993)? The chances are that you answered ‘no’ to both questions, illustrating the high context dependency of operational risk.

Context dependency is driven by how quickly the underlying system or process changes. Many market risks appear to have a moderate level of context dependency, as stock market prices tend to exhibit statistical properties that appear to be somewhat stable across time (for example, New York Stock Exchange behaviour in 1925 would be recognisable to a modern trader). Likewise, credit ratings and loss statistics have been measured for many decades and show some reliable properties. The level of context dependency has a fundamental impact on the ability to model and validate a system; in general, the higher the context dependency, the less the past will be a good predictor for the future.

For those risk types that exhibit low context dependency and have high data frequency, it is usually possible to identify risk patterns and test whether these properties hold true over time. That is, it is possible to use statistical methods to quantify the risk and to predict future outcomes. Conversely, for risk types that show high context dependency and low data frequency, it is inherently difficult to make predictions of their future size. Sufficient frequency of relevant data is critical for all risk modelling.

To summarise, operational risk has been divided into major and minor type events. It is arguable that adequate data exists to generate a distribution for minor events, so this can be treated with statistical methods, but these events are less important for risk. The primary challenge is addressing the major events that can adversely affect the capital of the firm, severely harm its reputation, or in extreme situations put it out of business. In this case, the high level of context dependency and the low level of relevant outcome data suggest that attempting to effectively quantify operational risk based on loss experience will be difficult because of the lack of data around major events.

Validation of operational risk models remains a major challenge. The causes of major events are often complex and due largely to human factors. The ability to predict future major events based on previous major events is difficult and questionable.

The ability to validate a model used to measure a given type of risk is also related to the frequency of outcome data from that risk. For market risk, model validation is relatively easy, by comparing daily VAR versus observed profit and loss (back testing). For credit risk, validation is possible but a longer time horizon – a number of years – is required, though other tools can also help close the gap. In contrast, information about major operational risk loss data is infrequent compared with

market and credit risks. A fundamental challenge for any operational risk model is that the system changes in character (context dependency) before adequate data is accumulated to validate the model.

Application to financial services

SPC has been shaped largely in the context of product manufacturing. As such, its practices need to be adapted to the somewhat different circumstances of the financial services industry. In some ways, however, its application may well be easier in finance. For example, the daily number of failed trades or unmatched confirms is already a sample of a significant number of individual transactions. As such, these are likely to be normally distributed.

Some experts in the field of SPC advise financial executives should look to their peers in manufacturing for important lessons in the analysis and control of operational risk¹². However, there are unique problems in the application of SPC to finance, which will be discussed in Section 2.

Before turning to the finer problems is it worth considering the relationship between operational risk minimisation and the regulatory goals that have been defined as the optimum for any government, central banker, or prudential supervisor¹³.

1.4 Operational Risk in relation to regulatory goals of Stability, Safety, Confidence and Convenience

In Australia various reviews of the financial system, such as the Campbell Committee (1979/80), the Martin Committee (1991/2) and the Wallis Inquiry (1996/7) have emphasised the goals of efficiency on an allocative, dynamic, and operational level paying lip service to delimiting the achievement of productivity gains within boundaries of total systemic stability and safety. With Basel II, stability and safety are given pre-eminence over efficiency and convenience, confidence being considered a vital input the achievement of the former goals. Minimisation of operational risk has for the first time been mentioned in the official literature of the chief policy maker of prudential supervisory guidelines, with the commencement of the process to refine Basel I announced by the Deputy Secretary to the Basle Committee of Prudential Supervision, on 2nd June, 1999 in London at a meeting of the Commonwealth Business Council.

Some of the main reasons for this have been not only the huge losses incurred in the early nineties by the rapid expansion into new markets, credit growth and derivatives trading but also by the Asian Crisis, disasters in the insurance sector and some very large losses incurred by flawed recording procedures, unauthorised trading and bad governance, Barings being a perfect example.

In the first section of the paper we reviewed great bank failures documented by Benton Gup, which although could be attributed to different factors could all be traced to one of the nine sources of operational risk detailed in Table 2 of which fraud appears to be the dominant cause. According to data compiled by Aon, the insurance company¹⁴, fraud is a far greater operational risk than banks have been prepared to admit. In October, 2003, Chicago-based Aon launched an operational loss risk database, Aon OpBase, which it says is the first commercially available database of op risk losses based on records of actual insurance claims, rather than just publicly reported losses. The database covers 12,000 risk events at 2,000 financial firms dating back 10 years, and throws up some sharp contrasts with the quantitative impact studies carried out by the Bank for International Settlements, which has been assessing the effect on banks of its proposals for a new Accord on regulatory capital – Basel II.

¹² Refer to related articles on www.Baselalert.com - [Breaking down the model; Asset manager technology hinders op risk management; Geithner to replace McDonough at New York Fed ; Algo to release flagship Basel II-compliant system in January; 'A good deal for regulators and banks' ; Black Thursday; China's regulator publishes new draft derivatives guidelines; ; Weasel parade; Geopolitical futures: The politics of betting ; FSA warns of treasury management flaws](#)

¹³ Sinkey Jr, J.F., 1992. Commercial Bank Financial Management. Maxwell MacMillan

¹⁴ **Op Risk database reveals fraud costs**, *Matthew Crabbe, Risk* November 2003 Vol 16 / No 11.

In particular, banks seem to have been reluctant to disclose details of frauds they have suffered, even privately, to each other. The third and most recent Basel quantitative impact study – QIS3 – concluded that 98% of losses through fraud were for sums less than \$1 million. However, Aon says the mean size of bank fraud is \$3.5 million, even after stripping outlying mega-frauds, such as that of Nick Leeson and John Rusnak.

The reason for the different results,

*“is that banks don’t like reporting frauds if they don’t have to, and they certainly like to keep reports of their frauds away from the press, especially larger internal frauds. The average size of internal frauds reported by banks in QIS3 was \$300,000, and \$68,000 for external frauds. The Aon database finds the average to be \$3 million and \$1 million respectively”.*¹⁵

Other op risk databases have been developed by rating agency Fitch and systems and software vendor SAS. There are also some bank consortia projects, such as the Operational Risk Exchange (ORX) and the British Bankers’ Association database.

Under the Basel II regime, effective from January 1, 2007, banks will be encouraged to source external data on op risks before insuring themselves against risks or set aside appropriate levels of capital.¹⁶ Financial institutions will need to understand how insurance prices respond to the cost of losses, as not all op risks can be covered by insurance, with banks having to rely on internal controls and management processes.¹⁷

Therefore, we can summarise the principal argument for the inclusion of operating risk in Basel II requirements is that in qualitatively and quantitatively analysing, reporting and instituting documented internal controls which are to be subjected to regulatory scrutiny is equivalent to insuring against fraud.

How exactly then does increasing or relating the level of bank capital to operating risk quality and quantity measures minimise or insure against fraud and the other eight sources of op risk?

2.0 Is the Provision of Additional Capital the Solution?

2.1 Role of Bank Capital

Banking theorists and regulators maintain that the role of capital is to act as a buffer against potential losses and to promote confidence of investors and creditors.¹⁸ However in the event of severe credit risk and operational risk control failures, losses have often equalled bank capital.¹⁹ Two case studies will illustrate failure of governance mechanisms in the corporate customer base of the financial system together with information asymmetry and flawed diagnostic monitoring by lenders were recipes for disaster. The questions posed by these case studies are,

- *“Would operational risk analysis and increased capital adequacy prevented these disasters?” and,*
- *“Did the institutionalisation of operational risk measures after the bank crisis rescue the failing firm?”*

¹⁵ Crabbe, 2003 (op.cit.)

¹⁶ Related Articles from www.Baselalert.com: [Regulators' operational risk definitions criticised](#); [Sponsor's article > Credit risk catches up](#); [Benchmarking asset correlations](#); [Wachovia picks Centerprise for Operational Risk Management](#); [Economic capital – how much do you really need?](#) [Industry KRI study takes off](#); [Understanding the expected loss debate](#); [Despite concerns, banks act on Basel II](#); [Sponsor's article > When is best practice good enough?](#); [Basel II Accord will reshape global banking, says Mercer Oliver Wyman](#);

¹⁷ Jonathan Humphries, associate director at Aon Professional Risks in London.

¹⁸ Sinkey, 2000 (op.cit).

¹⁹ See cases in Gup (2000).

The **first case study** is more a generic coverage of corporate failures that erupted in the US economy in the beginning of 2001 – Enron, WorldCom, Tyco, Adelphia, HealthSouth and others, which undermined confidence in the US business system and raised questions about corporate governance mechanisms.²⁰ From the perspective of financial institutions who are meant to be expert diagnostic monitors, acting as filters between the suppliers of information and other users, *“Why did the gatekeepers ... not uncover the financial fraud and earnings manipulation that occurred, and alert investors to potential discrepancies and problems long before the consequences came crashing down on them in the form of plummeting stock values? Are the incentives of gatekeepers consistent with those of shareholders and investors?”*²¹

Edwards’ (2003) conclusion attributes these failures more to flaws in external operational risk controls in the regulatory model which allowed huge executive compensation, while earnings restatements increased, becoming part of the US business culture. Although there were obvious fiduciary failures of boards – *“breach of its duties of care, loyalty, and candour ... because it allowed Enron to engage in high risk accounting, inappropriate conflict of interest transactions, extensive undisclosed off-the-books activities, inappropriate public disclosure and excessive compensation”*²² - these disasters have resulted in new legislation to change the regulatory model such as the ‘Public Company Accounting Reform and Investor Protection Act of 2002’ known as the Sarbanes-Oxley Act²³ and new NYSE governance rules. This new legislation is structured to improve board performance by increasing the role of independent directors, by requiring adherence to specific processes and procedures, and by enhancing greater market discipline through greater disclosure of off-balance sheet arrangements and other transactions.

From the perspective of financial institutions involved as a provider of loans and other services and products, it is obvious that a requirement to increase capital to provide for operational risk, and to review, document and measure all forms of such risk, may highlight flaws in procedures that lead to relationships with non creditworthy customers, called corporate cowboys or white collar criminals during the eighties. However, this by itself, *in the absence of an appropriate change in the culture within the financial institution itself, together with the injection of new thinking, processes and systems, and the recognition of flaws in the external regulatory model governing corporate behaviour and information disclosure*, will do nothing to prevent such disasters in the future.

The **second case** to illustrate the relationship between operating risk and bank capital, or lack thereof, involves analysis of why the largest savings bank in Italy failed and how it was turned around (refer to diagrams below). Brief introductory facts illustrate that this failure could be attributed to changes in the external environment combined with poor credit risk procedures, analysis, culture, and management leading to credit losses while operating expenses volumed.

²⁰ **U.S. Corporate Governance: What Went Wrong and Can It Be Fixed?**, Franklin R. Edwards, Paper prepared for B.I.S. and Federal Reserve Bank of Chicago conference, “Market Discipline: The Evidence across Countries and Industries”, Chicago, Oct. 30 – Nov. 1, 2003.

²¹ Edwards, 2003 (o.cit. p. 10).

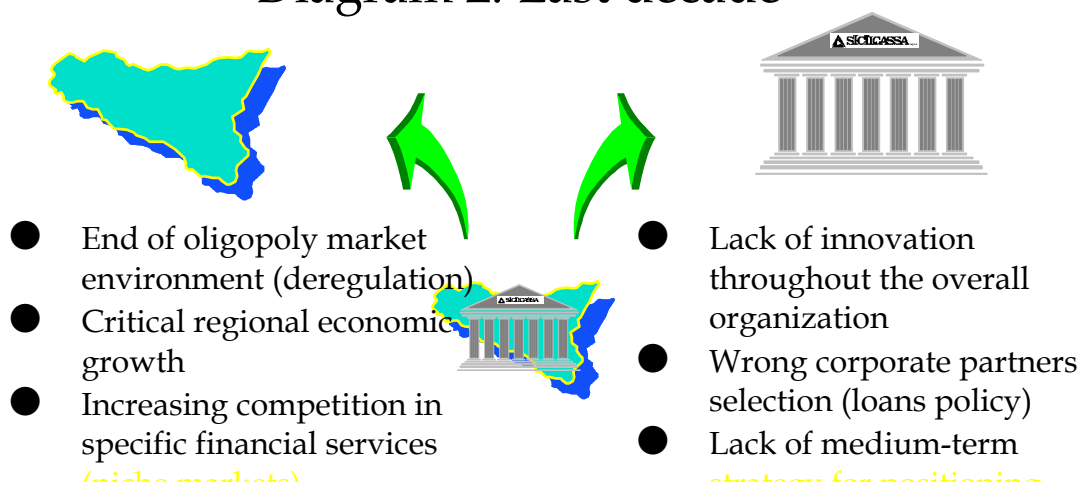
²² Permanent Subcommittee on Investigations, Committee on Governmental Affairs, United States Senate, July 8, 2002.

²³ 15 U.S.C. sec 7201 et seq., 107 Pub. L. No. 204, 116 Stat. 745

Diagram 1: The largest savings bank in southern Italy



Diagram 2: Last decade

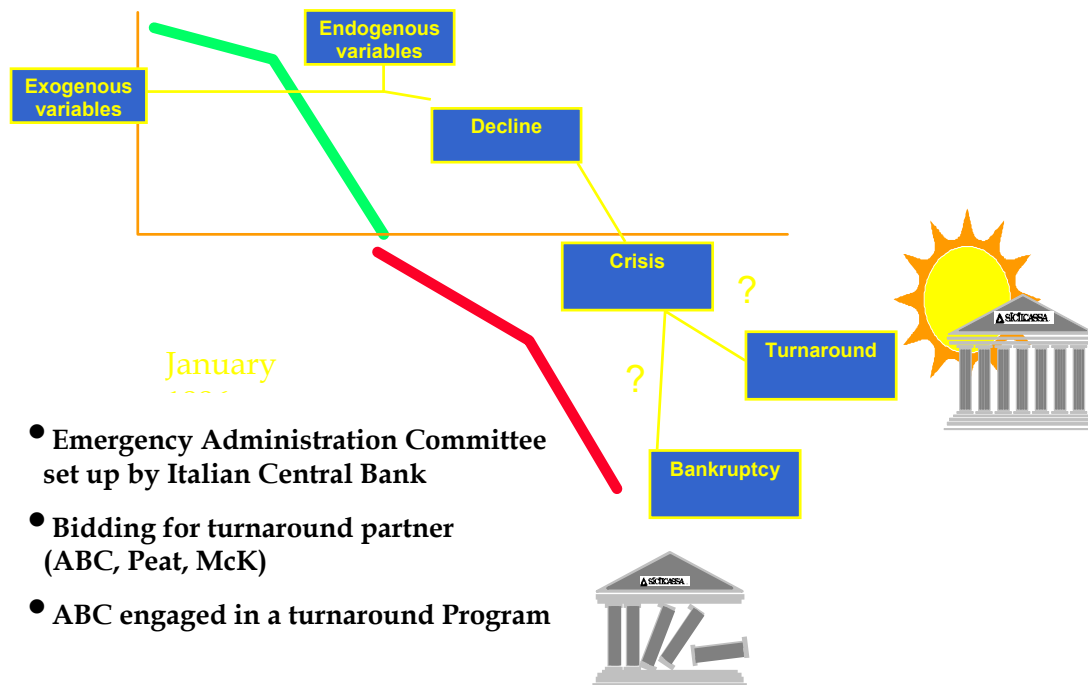


Typical customer base losses, resulting from market perceptions of diminished creditworthiness, drained liquidity. Consultants concluded,

- Branch network highly inefficient and completely lacking in sales effectiveness and structured approach
- Lack of innovative products with high service margins
- Extremely low competencies in core business activities
- Low productivity throughout all banking processes both at Head Quarter and Sales Network Levels (overcapacity)
- No zero base budget and limited control and responsibility allocation on overhead expenses
- Complete absence of management by objective approach
- Lack of technological innovation, in particular concerning budgeting and control procedures

- Extremely high credit losses due to bad debts and inefficient loan processes

Diagram 3: Last five years continuous fall of profitability



The bank was turned around through the following course of action:

- Communication Plan and action for
 - shareholders negotiation
 - management motivation
 - local opinions leaders involvement
 - customers toll free number set up
- Personnel outsourcing program
- Overhead and administrative expenses reduction
- New pricing policies
- Non strategic branches and shares dismissed
- High potential personnel selection
- Core competencies selected training
- New business process empowerment (Budgeting, Sales, Bad Credit recovering) and Sales network reorganization
- Tableau de Bord for CEO and top management
- Critical structures reorganization (Marketing, HR, Planning and Budgeting)

So what does this case study prove – that the causes of bank failure are a complex interaction of factors that are difficult to divide between simple categories of credit and operational risk? Similarly correcting those factors requires dramatic shifts in strategic thinking which do not solely rely on correct risk management but also focus on the bank seeking appropriate avenues to earn returns for the shareholders.

2.2 Effect on Profitability and Efficiency on OR requirements

The strategic importance of loan pricing is the direct impact on lenders' revenue that will contribute to the future accumulation of capital. On average in a bank financial institution (BFI) loans represent approximately 70% of earning risk assets of which between 40-50% are commercial loans. The profitability of loan portfolios is affected by a variety of interacting factors: volatility, globalization, competition, customer sophistication, macroeconomic indicators. However regulation of the markets is probably the most dominant component.

Any banking text²⁴ will teach students that loan-pricing decisions should seek to maximise a bank's market value. Banks need to develop a loan pricing system for its loan applicants that is based on the effect on the bank's long term returns. Indirect influences on loan pricing include macroeconomic events, the action of competitors, borrowers, and investors, the bank's own market strategies, shareholders long-term strategies.

Direct factors influencing the price of loan products include demand for the product, delivery cost, and level of risk, strategic factors and dominating these, funding costs. Although the critical point is that the pricing mechanism used in lending agreements must be consistent with the borrower's ability to pay, it also must be directly related to the credit risk of the customer, and the market and operating risk of the loan product. The former is a demand factor, the latter supply exigencies, but the elasticity of demand for the particular class of loans must also be considered in determining the price point – for instance, large high quality clients maybe more price sensitive, while medium or small clients may be price takers.

Methods of loan pricing include variable rate versus fixed rate, prime rates, a bank-pooled rate is used plus a margin, credit pricing, compensating balances, market determined, net interest margin, aggregate profitability. Often a pricing classification method is used which divides customers into **prime, perceived value and relationship** customers. **Prime customers** are the largest and most creditworthy borrowers who are eligible to borrow short-term funds at close to market rates, require competitive rates, less likely to bundle services. **Perceived-Value customers** are those who will pay up to perceived value if they lack alternative cheaper sources of funds and view the loan as part of total banking relationship, as distinct from **Relationship Customers** where the loan pricing is conditioned by strong customer relationships where the customer uses abroad range of the BFI services. Here loan rates generally established at spread above a base cost of funds.

With each of these customer types BFIs use some form of **customer profitability analysis (CPA)** as a guideline to loan pricing. CPA is designed to evaluate all relevant expenses and revenues associated with a customers' total banking relationship to the banks target rate of return to shareholders. CPA avoids the cross subsidisation and subjectivity most frequently seen in the less sophisticated systems and becomes of greater importance as customers have multibank relationships. CPA can be viewed as defensive for existing business or aggressive pricing in an attempt to acquire new business.

The Stand-Alone Pricing Model depicted in Table 3 below is applied to customers who do not use the banks other services. Loans are priced at a spread over the bank's cost of funds. The spread is determined by the bank's target return on funds employed including a risk premium. A customer is credited with the bank income generated from servicing, commitment fees and from the value of deposit balances held by the borrower bank. This value is adjusted for reserve requirements and liquidity requirements of the bank, which are essentially non-interest or very low interest earning assets.

²⁴ Refer to Sinkey, 2000, (op.cit).

$$R_i = \frac{1}{1 - E \left[R(1 - k_i) + \frac{d}{1 - d} (R - R_D) + R_k k_i + C_i^* \right]}$$

where R_i = return on asset i

$E = 1/e$ where e = elasticity of demand for asset i

R = cost of deposits

d = reserve requirement as % of total assets

R_D = return paid on required reserves

k_i = capital requirement for asset i

R_k = cost of capital

C_i^* = marginal (non - funding) cost of asset i

With the **Relationship Pricing Model**, the focus is on the yield from the entire relationship. The loan price is based on the transfer price of funds, the target return on funds, the premium for credit risk. To meet the target return, income from servicing and commitment fees is included.

With **Loan-Account Profitability Models** revenues are accrued which include explicit service charges, loan interest, other fees as are costs – principally the cost of capital required as well as net funds used, the cost of deposit accounts held, the cost of services provided, commitment fees charged on unused line of credit (essentially the price of a call on future credit). Fees are related to the cost of being prepared to meet borrowing by maintaining excess liquidity. Other factors affecting are non-interest aspects, collateral requirements, loan maturity limits, and loan covenants.

All of these models will be subjected to Asset Liability Management guidelines of RAROC – that is earning the appropriate risk adjusted return on capital. Each product or service will be adjusted for its risk rating and the net return calculated and divided by the amount of capital required for each risk rated product or service. *Hence changes in capital adequacy resulting from including operational risk in the regulatory requirements will affect not only pricing but may also reduce the RAROC of customers and products/services so that banks restrict their supply.*

This brief and simplistic overview of pricing principles above illustrates the potential effect of changes in capital adequacy requirements on the cost to the end user, and hence the efficiency of the banking system, and on a macro level the productivity frontier for the entire economy. Questions arise from these considerations, which must be addressed by regulators:

- *“If the Basel II requirements result in increased demands for capital which is the most expensive source of funds for banks (bearing in mind the effect of franking of dividends and their non tax deductibility compared to interest), will this reduce the growth rate of an economy and lead to diminished per capita income?”*
- *“How much have economies in the past benefited from cheap sources of funds?”*
- *“Provided bank management ensure optimum risk minimisation strategies are in place, does a BFI need additional capital to cope with operational risk over and above providing for credit risk?”*
- *“Are BFIs facing an environment with increased operating risk levels that necessitate the urgent introduction of Basel II?”*

2.3 Exact Basel II Requirements

The best source for current Basel II requirements on operational risk pending final clarification expected in 2004 is from a policy document called CP3²⁵, issued by the Bank for International

²⁵ Third Consultative Document, CP3, **The new Basel Capital Accord**, (Basel Committee on Banking Supervision, April, 2003).

Paper prepared for the IQPC Operational Risk Forum, 25th March, 2004, Carlton Crest Hotel, Sydney.

Presenter: Dr Carolyn V. Currie

Settlements in April 2003. This was the result of previous consultations with industry.²⁶ Since then the UK Financial Services Authority has issued several Consultation papers which are the best overview of implementation methods and difficulties for Operational Risk (OR), the most informative being that published in July 2002.²⁷ This paper called for comments and resulted in the UK proposed Prudential Standard **PRU 6.1** policy on risk management systems for OR, and a review by ORIAG (the Operational Risk Implementation Advisory Group) on how management of OR is evolving in firms in July, 2003.²⁸

Due to major concerns expressed by a number of organisations about practical impediments to the cross-border implementation of an Advanced Measurement Approach (AMA) for operational risk, the Basel Committee issued in January 2004 a further policy statement.²⁹ The policy document suggested a “hybrid” approach for AMA banks under which a banking group would be permitted, subject to supervisory approval, to use a combination of stand-alone AMA calculations for significantly active banking subsidiaries, and an allocation portion of the group-wide AMA capital requirement for other internationally active banking subsidiaries.

However, we need to take a step back and clarify what exactly is being proposed in the recognition and management of operational risk in financial institutions. Basel II will for the first time require firms to incorporate an explicit measure of operational risk into their regulatory capital requirements. Firms can choose from three main approaches:

- **The Basic Indicator Approach (BIA)** where the capital requirement to be based on a fixed percentage (alpha) currently 15% of gross income.
- **The Standardised Approach (TSA)** where the capital charge is still based on gross income but the firm’s activities are divided along business lines, each with their own percentage (beta) charge.
- **The Advanced Measurement Approach (AMA)**, which allows firms to determine their operational risk capital requirement according to an internal model, providing it meets certain requirements.

Firms can use methods partially but if adopting an Advanced Measurement Approach (AMA) they must move a significant portion of business over. The basic requirements of each approach are described in Table 4.

²⁶ The most important and informative of the evolution of OR requirements for financial institutions are **Sound Practices for the Management and Supervision of Operational Risk**, Basel Committee on Banking Supervision (Bank for International Settlements, July 2002); Risk Management Group, **The 2002 Loss Data Collection Exercise for Operational Risk: Summary of the Data Collected**, Basel Committee on Banking Supervision, March 2003.

²⁷ Consultation Paper No. 142, **Operational risk systems and controls**, Financial Service Authority, July 2002.

²⁸ ORIAG, **Implementation of the Capital Accord for Operational Risk**, (Working Paper, Financial Service Authority, UK, 12 February, 2003).

²⁹ Basel Committee on Banking Supervision, **Principles for the home-host recognition of AMA operational risk capital**, (Bank for International Settlements, January 2004).

Table 4: Three approaches to OR used for capital calculations

BASIC INDICATOR APPROACH	STANDARDISED APPROACH	ADVANCED MEASUREMENT APPROACH (AMA)
Not allowed for international banks and institutions with high risk	Intermediate stage Not risk sensitive	Fully developed operational risk management – risk sensitive
Not risk sensitive	Calculate gross income per standard business line from 2004	Start loss data collection in 2004

Basel II requirements for Operational Risk can be described as a trade-off between efficiency and complexity. For the Advanced Measurement Approach, the internal measurement system must estimate unexpected losses based on a combination of internal and external data, scenario analysis, and bank-specific environment and internal controls. *The internal measurement system must be capable of supporting allocation of economic capital to business units in a fashion that creates incentive for them to improve their operational risk management*

The implications for advanced approaches for operational assessment are that it,

1. *Requires a comprehensive enterprise-wide framework;*
2. *Combines the use of quantitative and qualitative analysis;*
3. *Tailored solutions are necessary if activities and capabilities across business units are varied;*
4. *Implementation plans must be put in place across Groups.*

A significant level of effort is required to comply with Basel II operational risk requirements. Table 5 describes measures that are necessary to implement appropriate OR risk measurement and management systems whereas Table 6 describes the actual processes.

Table 5: Input requirements for an operational risk measurement and management system

IDENTIFY EVENTS	MEASURE ASSETS	MANAGE AND MITIGATE	CONTROL AND REPORT
Qualitative Self Assessment	Modeling Operational value at risk	Risk Management eg Insurance	Business unit and management reporting
Qualitative risk indicators with scenario analysis			MIS and BIS disclosure

Table 6: Overview of Internal Model Processes- Operational Value at Risk Equation

RELEVANCE AND EXPOSURE	VERIFICATION	TRANSFERS	QUALITY
Link internal and external losses to business units and confirm exposure to all risk categories	Verify VAR lies within Extreme Value Theory (EVT) interval	Adjust VAR for loss coverage Provided by insurance programmes	Incorporate Quality at the business control environment
Determine VAR from distribution of internal and external historical losses	Modeling	Modeling	Evaluation

Overriding this there must be an Operational Risk Policy Framework – with procedures covering -

- Risk assessment and approval
- Business risk management
- Third party risk
- Business continuity management
- Fraud risk management
- Operational loss reporting
- Non-lending loss ownership
- Model risk

The above description appears simple. However, there are some huge obstacles as pointed out in the section below.

2.4 Difficulties in Measuring Operational Risk

According to some expert commentators³⁰, although the Basel Committee has worked constructively with the industry to relax some of the more awkward elements of the initial Pillar 1 approach, substantial challenges still remain. Some say these issues are just temporary hurdles – if the industry tries a little harder, operational risk models will develop into reliable and useful elements of risk management practice. *However, what if these challenges are fundamental and that modelling operational risk may not be a well grounded or even a useful aim?* This section will put forward the views of two experts in the field – Holmes (2003) and Lawrence (2003)³¹ to illustrate the possibilities that:

- current proposed approaches do not qualify as ‘risk models’
- why these difficulties may be more than temporary as the proposed parameters for measuring risk are not achievable.

Holmes (2003) categorises the challenges of quantifying operational risk as follows:

- **Lack of position equivalence.** The lack of a quantifiable size (analogous to a risk sensitivity or exposure amount) in operational risk is a fundamental difference from credit or market risk. To this Lawrence (2003) would add **objections to the soundness standard** which is says is comparable to the Internal Ratings Based Approach to credit risk and requires a one year holding period and a 99.9% confidence level. Hence, measures must capture potentially severe tail loss events and thus

³⁰ Refer to **Operational Risk Implications of Basel II/CP3**, Dr David Lawrence, Vice President, Citibank, N.A., Risk Forum, 19 June, 2003(www.Baselalert.com, Risk Magazine, June, 200) and **Measuring operational risk: a reality check**, Mark Holmes, **Risk** September 2003 Vol 16 / No 9.

³¹ *ibid.*

may overstate the risk. Risk mitigation is capped at 20% and floor on total capital reduction versus Basel 1 is 90% - >80%.

- **Completeness of the portfolio of operational risk exposures.** Unlike market or credit risk, it is difficult to determine whether the portfolio of operational risks for a bank is complete. Lawrence (2003) would add to this an objection that the Basel II OR definition excludes the most important risks that result from an OR mistake – an increase in strategic and reputation risk levels, but includes legal risk, which should be in a separate category.

- **Context dependency and relevance of loss data.** Loss data is affected by continual change of organisations and the evolution of the environment in which they operate, degrading the relevance of this information over time. Lawrence (2003) also objects to the measurement of regulatory capital as the sum of the expected loss (EL) and the unexpected loss (UL) unless the bank can demonstrate that it is adequately capturing EL in its internal business practices.

- **Validation difficulties.** The difficulty in validating operational risk models reduces the reliability or usefulness of these models in predicting future outcomes.

The result of the alleged flaws in the Basel II guidelines could be:

- If the bank is unable to use internally determined correlations, and in directly attempting to calculate the tail of an aggregate loss distribution will be subjected to extremely high errors due to insufficient statistics, overstatement of risk may result in providing capital far in excess of what is prudently required.
- Measuring expected loss is not an accurate process but at best an estimate based on past experience. Meanwhile accounting for expected losses is done in the budgetary process through reserves, pricing or expensing policies so that reserves will cover expected losses, and capital should only cover unexpected losses.

Further validation problems arise from the *granularity requirement* – that the bank's risk measurement system must capture all the major drivers of operational risk affecting the shape of the tail of the loss estimates. As pointed out by Lawrence (2003) if you use a LDA (Loss Distribution Approach) the 99.9% point on the aggregate loss distribution requires knowledge of the 99.9999% on the severity distribution – an extremely inaccurate method, so financial institutions can either choose a lower point or scale up by assuming some sensible distribution.

Lawrence (2003) also objects to the *correlation requirement* – that if the bank can validate correlation assumptions or otherwise, capital adequacy need not be as high. Lawrence thinks that even deriving correlations between disparate events reaches the heights of statistical absurdity. Even deriving the internal data Lawrence perceives as a problem – recording all OR losses and the less event types with a de minimus gross loss threshold for internal loss data collection, for example, 10,000 mapped to seven regulatory event types, with credit risk losses separately flagged within internal OR databases. So at first OR loss databases must initially record but then exclude credit losses and the de minimus requirement results in capturing of near misses. Where a bank has various business lines assignment of OR losses will be difficult to justify as will collection of pre merger data after an acquisition.

The requirement to use relevant external data especially when there is reason to believe that the bank is exposed to infrequent, but potentially severe losses is tautological, as all banks are subject to exogenous events, and how does management ensure that external data is relevant without adjusting it to make it so. Scenario analysis is advocated in CP3 has a wide variety of interpretations, such as adding a data point, setting parameters, modifying external and internal factors, verifying resultant capital is reasonable. In addition, a banks loss data must capture future external and internal factors that could change its OR profile. Problems of justification, sensitivity, documentation, and validation arise from this standard, such as the 99.9% confidence level meaning that data should cover 100 years. Insufficient statistics and proving correlations between Key Risk indicators has led to failure to establish valid loss database for OR. Finally Lawrence (2003) objects to the small reduction in regulatory capital by 20% if correlations can be validated, which could result in a financial institution taking less insurance and hence incurring greater risk.

Finally, there are problems of home host issues, but these will be covered in a separate section of this conference and have led to the issuance of further guidelines in January this year (see Section 2.3 above). To conclude, for Basel II in 2004 to gain international acceptance, not just by the European Union but worldwide, objections by one of the oldest regulators must be answered.

3.0 Is Operational Risk the bugbear of Basel II - Differences in regulatory attitudes and approaches of banks

3.1 The Basis of the Dispute

Throughout the Basel Accord revision process, US regulators have had a reputation for going their own way on key issues, and the Securities and Exchange Commission (SEC) is no exception³². Not only were most financial industry executives unaware that the SEC was working on its own version of a Basel II implementation code for investment banks and broker-dealers, but they were surprised to read what the SEC produced. The SEC announced at the beginning of October 2003 that it would be publishing two sets of proposed rules, titled "Supervised investment bank holding companies", and "Alternative net capital requirements for broker-dealers that are part of consolidated supervised entities". The SEC was strong-armed into producing the rules - the EU had recently passed its Financial Groups Directive, which would have forced US investment banks and broker-dealers with EU operations to completely ring-fence those subsidiaries because the SEC did not supervise on a consolidated basis. Up until the publication of these rules, firms such as Morgan Stanley and Goldman Sachs would have been forced to implement Basel II rules in the EU, but would have remained under the SEC's net capital rule for their US operations.

The proposals were finally posted two weeks later on the SEC's website. The first surprise was the new definition for operational risk that the SEC included in the footnotes to the document written for investment banks -

"Operational risk encompasses the risk of loss due to the breakdown of controls within the firm including, but not limited to, unidentified limit excesses, unauthorised trading, fraud in trading or in back-office functions, inexperienced personnel, and unstable and easily accessed computer systems."

The document also strips out legal risk from the op risk definition as a separate risk category, noting that it "arises from possible risk of loss due to an unenforceable contract or an ultra vires act of a counterparty". These definitions are considerably narrower than those used by the Basel Committee in its operational risk capital charge framework. However, the SEC disagrees with other US regulators in the structure of its framework. The two documents do not resemble the US banking regulators' advance notice of proposed rulemaking (ANPR)-

Both sets of SEC rules are "**voluntary**", with no firm asked to comply with the new capital frameworks on a mandatory basis. In contrast, in the US, 11 commercial banks have been told by regulators that they must adopt the US Basel II framework, while 10 more plan to do so on a voluntary basis. In the EU, US investment banks and broker-dealers with operations will have to submit to the new SEC rules, or else segment their European operations. In addition, the SEC asks firms to comment on all three op risk approaches - the basic indicator, standardised, and the advanced measurement approaches (BIA, STA, and AMA respectively). In contrast, the US commercial banking regulators will only be allowing the firms they oversee to adopt the AMA, if they are taking part in the Basel II framework. However, pundits point out that the wording of the SEC proposals leaves the door open for potential modification of all three approaches.

Investment banks were hit particularly hard by the business line multipliers under Basel's STA, which effectively place higher capital charges on their core areas, such as sales and trading. The

³² **SEC produces maverick Basel II framework, redefines op risk, Ellen Leander, Operational Risk** November 2003 Vol 4 / Issue 11

SEC's non-committal approach to an op risk framework gives industry officials a fresh opportunity to lobby for changes on this issue, and others. Investment banks would be required to *"establish, document, and maintain a system of internal risk management controls to assist it in managing the risks associated with its business activities"*, including op risk and legal risk. In addition, investment banks would be required to *"establish, document, and maintain procedures for the detection and prevention of money laundering and terrorist financing as part of its internal risk management control system"*. Records of a firm's business contingency plans must also be on hand for regulators.

As pointed out by Leander (2003) the SEC's document is short on detail when it comes to what will be expected from an internal risk management control framework. The document says that a framework must be appropriate for the business, and needs to consider, *"among other things, the sophistication, and experience of its operations, risk management, and audit personnel, as well as the separation of duties among these personnel, when designing and implementing its internal control system's guidelines, policies, and procedures"*. The Public Company Accounting Oversight Board (PCAOB) is expected to provide guidance to accountants as to the nature and structure of these reports, as part of the Sarbanes-Oxley Act's mandates. Indeed, the PCAOB published for consultation, an audit of internal control over financial reporting performed in conjunction with an audit of financial statements at the beginning of October. However, these rules are meant for companies in general, and are not created specifically for financial firms.

Reporting requirements will be quite substantial. Investment banks will be required to file monthly risk reports with the SEC, which would include consolidated financial statements for the group, and capital calculations for market, credit, and op risk, among other things. Quarterly reports must include disclosure of all legal risks as defined under generally accepted accounting principles. On an annual basis, firms will have to file a supplemental report prepared by an accountant that provides the accountant's view of the firm's internal risk management control system. Over-the-counter derivatives dealers would have to submit a separate supplemental report by an accountant about the internal risk management and control system of those divisions.

The SEC expects that six investment banks and broker-dealers will volunteer to be supervised under the new rules. Officials from the SEC declined repeated requests for comment to this story. Industry comments are due in to the SEC on February 4, 2004³³. The next section will consider current solutions that financial institutions are adopting.

3.1 Current approaches – an overview of systems and software solutions

With Basel II set for implementation in three years' time, some banks in the Asia Pacific region are working hard to align their operational risk systems with the requirements outlined in the new Accord³⁴.

Six years ago, Commonwealth Bank of Australia (CBA) developed an approach to operational risk management based on self-assessment and scenario analysis of risks. The bank's business units make their own assessments, identifying risks within their area of operations – an approach that ensures accountability and ownership of risks. Meanwhile, the use of scenario analysis enables the bank to look at how it would cope with possible events in the future. The alleged advantage of scenario analysis is that, *"Scenarios articulate the potential risks the bank and its businesses are exposed to, the controls that are in place and the distribution of potential losses that may be incurred from the risk"*. The results of the scenarios are used in an in-house developed operational risk capital model to calculate and allocate economic capital to the business units.

This approach incorporates many of the principles set out by the Switzerland-based Basel Committee on Banking Supervision – in set of guidelines published in February 2003 (Sound Practices for the Management and Supervision of Operational Risk). Although CBA uses

³³ To view the proposals, visit: www.sec.gov/rules/proposed.shtml

³⁴ **Countdown to Basel II**, Clive Davidson, *Asia Risk* October 2003

information on internal and external loss events to help determine scenarios, at the moment it does not use these as a direct input to its model calculations. However, it is now collecting internal loss data in a more formalised way for this purpose.

For the past 20 years, National Australia Bank (NAB) has been collecting data on internal losses over a certain dollar threshold across all its business lines. Since 2000, it has been using this information as an input to an operational risk value-at-risk (VAR) model supplied by a third party that the bank would not name. Relevant external data is also used to help calculate the appropriate internal economic operational risk capital requirement. Capital charges are then charged back to individual business units as part of the economic capital usage framework. This charge is affected by the quality of the control measures within each business unit.

NAB and CBA represent the two different basic approaches that banks have taken so far to operational risk management. With its focus on loss data to calculate economic operational risk capital that is then charged back to individual business units, NAB's approach is known as 'top down', while CBA has taken a 'bottom-up' approach by focusing on the assessment of risk at ground level and feeding that information up to an overall capital calculation. An external analyst would conclude that NAB's recent discovery of foreign exchange mismanagement is an indictment of the top down approach, but full facts of causes are yet to emerge.

Ultimately, banks may need to take both approaches, as a top-down approach allows you to get an estimate of the total capital that is required for the safety of the institution. However, it does not really help management make better decisions about where to focus operational risk management efforts because it does not get granular enough. The bottom-up approach is a good way of understanding the particular strategy and niche in the market of a financial institutions and where risk might be that management can do something about. The bottom-up approach will also eventually lead to a capital calculation, and if this is in the same range as the top-down calculation the figures will validate each other, or if not, they will indicate the need for investigation. Therefore, banks may need to use both approaches concurrently.

By building up a database of internal loss data as well as key risk indicators – areas that are analysed to provide insight on levels of risk and whether these are changing – the CBA is adding the top-down approach to its operational risk methodology. According to Davidson (2003), the scenario analysis process will be developed to include loss data and risk and control indicators as explicit inputs into the scenarios. This will facilitate greater objectivity, validation capability, and more efficient updating of the risk scenarios. It will also provide a more transparent link between risk management initiatives, reporting of trends in losses and indicators, and the capital being charged to businesses.

Meanwhile, NAB is introducing a bottom-up scorecard-based self-assessment system. This in-house tool is designed to capture a business unit's risk profile through a combination of self-assessment and independent review and to form the cornerstone of risk control and performance measures in front line businesses and feed into the operational risk VAR model.

Tokyo-based UFJ Holdings also runs a VAR model to calculate operational risk economic capital, which is charged back to its business units in a combination of bottom-up and top-down approaches. The approach starts from extensive qualitative assessment of individual processes and systems. Then loss scenarios are created for the processes and systems where internal control weaknesses are identified. These scenario losses are then incorporated with the internal historical loss data, to form a loss data body. Finally, a VAR model is run on this loss data body and the results are incorporated into the risk capital management framework and charged to business units. In addition, the bank uses key risk indicators as a source of information to help senior management judge the operational risk profile of the bank, although the indicators are not directly used for the VAR model. Likewise, external loss data is not directly used in the model, but staff takes the loss experiences of the bank's peers into consideration when creating loss scenarios.

The developments undertaken by UFJ, CBA, and NAB are all being done with Basel II in mind. All three banks now have the basis for Basel II's advanced measurement approach (AMA), which will allow banks that are able to quantify their exposures using approved models and methodologies to reduce their regulatory capital. Davidson (2003) considers the major Australian banks are considered to be well placed internationally to qualify for AMA status under Basel II due to significant investments in operational risk frameworks and models in past years. However, this view was expressed prior to NAB's announced losses.

Although the banks began their operational risk management projects mostly using in-house developed tools, some are increasingly looking to the evolving third-party applications that are available from companies such as OpVantage, North Carolina-based analytical and risk software specialist SAS and Toronto-based risk software specialist Algorithmics and Sydney based Corprofit, which is being trialled by the CBA, which may expand and progress the functionality of its operational risk management systems in light of a current review. The most likely approach taken will be a mixture of bought and internally developed software tools to form, as far as possible, an integrated solution.

In terms of the functionality of operational risk management applications, there does not seem to be any special requirements for the region. However, the region does face some issues in the implementation of the software. Some exposures will differ for a start. In the US, there tends to be more sales practices losses and as a result, more effort being placed on controlling sales people to make sure they do not violate policy guidelines and put the firm at risk in terms of disclosure. This risk exists elsewhere such as in Europe where the UK FSA is running training programmes for financial institutions to prevent this.³⁵ However, it is not considered to exist to great an extent in Asia. The same operational risk management framework and technology can still be used for the various local exposures, but organisations have to ensure that they are capturing the information relevant to the risks in their market. Asia could have more difficulty with external loss data than other regions.

In order to help financial institutions gain access to external loss data, SAS runs a database where banks can pool data on their losses in order to give them a broader and more objective view of potential exposures. Although a number of US and European banks have already signed up for the database and are sharing their loss information, there may be more reluctance to do so in Asia. Davidson (2003) claims that "Getting banks anywhere to report loss information honestly and comprehensively is a challenge and once it's reported internally, getting them to share this information to the fullest extent with other organisations is an even greater challenge - even though the industry initiatives are based on the assumption that the data will be rendered anonymous, there is still a lot of sensitivity around this and there is probably more sensitivity in Asia than the US and Europe given Asian cultures and issues relating to losing face."

Although Basel II is a key driver in the development of operational risk management in the region, banks are not the only financial institutions to be revamping their operational risk capabilities. Two years ago, London-based asset management firm Schroders commissioned financial IT specialist Comit, based in Ireland, to develop an operational risk management application to its specifications. One of the key requirements was that the application could be distributed across the firm's global operations, including its offices in Singapore, Taiwan, Japan, China, South Korea, Indonesia, and Australia.

Although buy-side regulators are not breathing down the necks of firms on operational risk in the same way that banking regulators are today, Schroders believes it was important to be able to demonstrate that it had a sound approach to the issue. In order to placate clients and consultants who want proof. The decline in the markets in recent years has prompted a greater demand for transparency of operations among firms. Internal pressures for improved risk management capabilities reinforced these external demands on the firm. For example, the firm's Singapore

³⁵ Refer to their website - <http://www.fsa.gov.uk/industry-training/>

office, where there is a heightened awareness of risk following the Barings fiasco, felt it would be beneficial for its business that it was seen to be in the vanguard of risk management. "If you are an international house competing with local firms then it is important to be able to demonstrate rigorous risk management," reports Davidson (2003)³⁶.

4.0 Conclusion – Op Risk – A Micro and Macro Cost Benefit Analysis

Holmes (2003) has put forward the best summary of the pros and cons of attempting to quantify and provide for operational risk via capital adequacy.³⁷ He claims that against the argument of unattainability is the defence that attempting to model op risk, even if not scientific or reliable, may force firms to carry more capital and encourage better behaviour. Antagonists would reply that building a system on a weak foundation has serious implications; it is possible, perhaps even likely, that such an approach will engender its own problems. There are potentially unintended consequences that arise from the use of operational risk models for practical risk management purposes, including:

- **False reliance.** Attempting to summarise all operational risk into a single measure could be misleading and dangerous. Senior management may be given the impression of having a level of control akin to market or credit risk, when in reality the model is incomplete and unverified. Models will become the lens through which operational risk is viewed and managed.
- **Management of the model rather than reality.** The output from an operational risk model may cause senior management to take actions that reduce the model estimate of operational risk, but not address real core issues. Perhaps worse, the Basel II proposals require management to rely on these models in their daily management process.
- **Misdirected focus.** There is a risk of misdirected focus on the types of operational risk loss events – high-frequency small-loss minor events – that can be quantified, rather than on the major risks. Operational risk models based on historic losses means management become 'prisoners to data history' and will always be focused on fighting the last war.
- **Misdirected resources.** Operational risk quantification will also require resources, to establish this system to a standard sufficient for regulatory satisfaction. This will naturally divert resources from other risk work that may have more value. For example, there would no doubt be numerous requests to validate or further improve these models, regardless of whether this is meaningful or possible.
- **Discouragement of 'whistle-blowers'.** In the proposed quantified operational risk environment, bad news is disincentivised by an additional capital charge. Could identification of new risks or events be discouraged in a regime where such news could bring an additional capital charge? Will there be some additional incentive to 'handle' such a situation in private or downplay its significance if it will attract more capital to the financial institution?³⁸

³⁶ Related Articles from www.Baselalert.com: [Complex issues must be resolved before Basel II can be implemented, says US regulator](#); [Rabobank upgrades software for Basel II compliance](#); [Mind the gap Kamakura upgrades credit default prediction software](#); [Testy politicians muscle in on Basel II negotiations](#); [US regulators may change Basel II rules, says Ferguson](#); [Bank of England publishes operational contingencies report](#); [Gay Evans is new head of the Joint Forum](#); [Securities firms must certify compliance with securities laws, says NASD](#); [FSA chief hits out at structured products](#) [Putting the European regulatory framework in place](#).

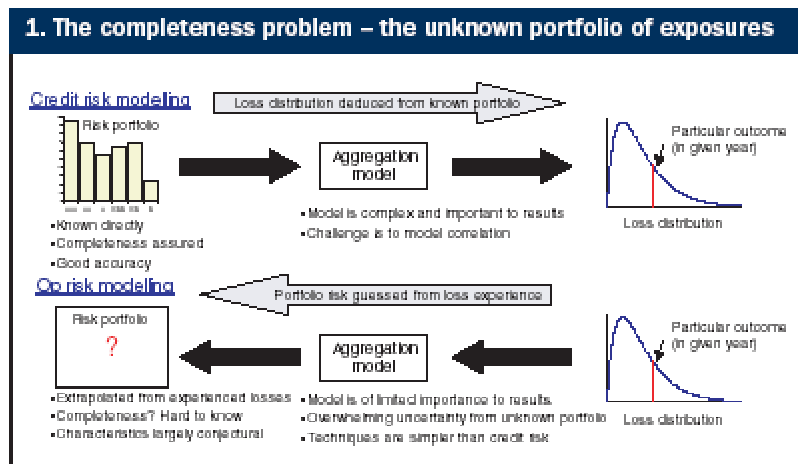
³⁷ Mark Holmes is a managing director of Credit Suisse First Boston and head of risk measurement and management, based in London. He makes no representation as to the accuracy or completeness of the information provided. The views expressed here are those of the author, and do not necessarily represent those of Credit Suisse First Boston or Credit Suisse Group. He would like to express his gratitude to Wilson Ervin, Tom Wilde, Andrew Cross, David Palmer and James Elder for their valuable input to this article

³⁸ 38

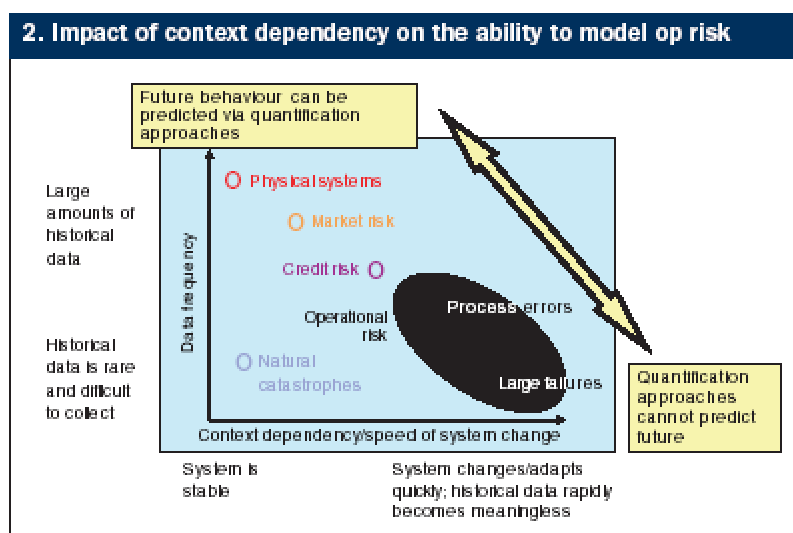
• **‘Blissful ignorance’.** Models that are based on self-assessments or scorecards rely on the veracity of the source. Self-assessors that have higher self-awareness and greater understanding of controls are more likely to accurately identify and report weaknesses than those who are unaware of potential control issues – there is a risk that the ‘boy scouts’ get punished while the ‘criminals’ go free.”.

Conclusions

- Modelling operational risk suffers from deep, possibly insurmountable, problems including lack of position equivalence, difficulties in determining completeness, context dependency and other issues. Refer to Table 1 below.³⁹



- Understanding the nature and measurability of operational risk is important when trying to develop a practical, realistic approach to managing this risk. That is it is necessary to understand context dependency - refer to Table 2 below.⁴⁰



- There is no evidence yet to suggest that operational risk is amenable to measurement to the same extent as market risk or credit risk, and that such models can be used to predict

³⁹ ibid

⁴⁰ Holmes (2003)

riskiness in a verifiable way. Refer to Table A below which compares the measurement of credit and market risk⁴¹.

A. Comparing operational risk with market risk and credit risk				
		Market risk	Credit risk	Operational risk
Risk position	Quantifiable exposure	Yes	Yes	Difficult*
	Exposure measure	Positive risk sensitivity	Money lent: potential exposure	Difficult – no ready position equivalent available
Completeness	Portfolio completeness	Known	Known	Unknown
Context dependency and data relevance	Context dependency	Low	Medium	High
	Data frequency	High	Medium	Low*
Measurement and validation	Risk assessment	VAR, stress testing; economic risk capital	Rating models; loss models; economic risk capital	No industry consensus
	Accuracy	Good	Reasonable	Low
	Testing	Adequate data for back-testing	Back-testing difficult to perform over short term	Results vary difficult to test over any time horizon
	Summary	Market risk models well-established and proven tools	Using models considered reasonable – but should be used with care	No industry consensus; models appear inadequate

* Unlikely other than for certain high-frequency, low-loss events, for example, settlement losses

- A falsely quantitative approach could create unintended consequences, possibly adverse ones. It could create a false sense of security, and divert attention and resources from other more effective risk reduction work.

There remain vital unanswered questions that must urgently be addressed by regulators;

1. If models had been in place in the past, how many high-impact operational risk events would have been predicted or prevented?
2. Will the industry, regulators, and shareholders benefit from this approach or will resources be wasted on modelling?
3. Should the main focus should be on the development of better operational risk management practices?
4. Will model results be tested for reliability and substance before they are inserted into the infrastructure of risk management?

Otherwise, the effect on lending from over or under providing capital for financial institutions may lead to a credit crunch. However as usually happens with new regulatory frontiers, schools of education and research will spring up so that the regulatory process will eventually result in advances.⁴²

⁴¹ *ibid*- **Related Articles from www.Baselalert.com:** [Major op risk software providers grow at expense of smaller rivals](#); [Sponsor's article > Accounting for revenue uncertainty](#); [UK regulator clamps down on structured product selling](#); [Building scenarios](#); [Top six HK banks may adopt IRB](#); [Bracing for Basel](#) [How good is your information? CreditVantage launches European credit risk database](#); [UK's FSA reforms ORIAG as ORSG](#); [NAB revises FX options losses to A\\$360 million](#); [Sponsor's event > Breakfast Briefing on Implementing the IRB Approach](#)

⁴² See for instance **Operational Risk – regulation, analysis and Management**, Carol Alexander (ed)., (Prentice Hall, 2003)