

**Challenges and Possible Solutions
in Enhancing Operational Risk Measurement**

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Note: This paper is circulated in order to stimulate discussion and comments. Views expressed in this paper are those of authors and do not necessarily reflect those of the Bank of Japan, the Financial and Payment System Office, or the Bank Examination and Surveillance Department.

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I. Introduction

We presented our Working Paper Series No.1 (WPS1) “Measuring Operational Risk in Major Japanese Banks” on the web-site of Financial and Payment System Office of the Bank of Japan in July 2000. The purpose of this paper (WPS3)¹ is to summarize the responses we have received on our earlier paper (WPS1) and to delineate our thoughts on those comments. Our thoughts are based on best practices and methodologies regarding how to measure market and credit risks.

After our first paper was put on the web-site, we received a lot of comments and questions on the paper. These comments and questions indicate that method of operational risk measurement is not only developing at present but also going to be enhanced in an accelerated pace in the near future. In order to make this momentum more robust and secured, we believe that it is important to share views on operational risk measurement among regulators, banks, and related industries. Thus, we welcome any further comments or questions on our papers (WPS1 and WPS3). We will answer these questions on the paper (WPS1) as much as possible.

II. Challenges and Possible Solutions

Overall, the responses were mainly from major banks, consulting firms and insurance companies on a global basis and they focus on topics related to 1) the method of VaR measurement and 2) event and loss data collection (hereafter: loss data collection²). The followings are general comments on our paper (WPS1) and the summary of questions and answers.

1. Measurement Methods

(1) General Comments

In our paper (WPS1), we introduced Statistical Measurement Approach for measuring VaR. In this approach, events of operational risks such as lost checks or errors in remittance could be captured in terms of their frequency and severity. These frequency and severity distributions generate loss distribution with Monte Carlo simulation. The mean and a certain percentile point are calculated in order to estimate

¹ We received useful comments from our colleagues: Messrs. Hiroataka Hideshima, Eiji Harada (Financial and Payment System Office) and Hiroshi Ashida (Bank Examination and Surveillance Department).

² Event and loss data are both event with loss data and event without loss data (please see the table1 in the section .Question & Answer (A)Scope of Measurement).

EL (expected losses) and UL (unexpected losses) respectively. This measurement of VaR is used to allocate economic capital to operational risks.

The comments on this approach indicate that measurement of operational risks is found to be at an evolutionary stage. There are three groups of banks in terms of measuring operational risks using VaR.

- (a) Those which have made little or no progress towards VaR method
- (b) Those which are considering or under way for using VaR method
- (c) Those which have developed and are using VaR method for economic capital allocation

It is found that from the comments of banks in group (b) and (c), the Statistical Measurement Approach for VaR method is commonly used in a similar way among a number of internationally active banks. It implies that this method could be de-facto standard for measuring operational VaR.

(2) Summary of Questions & Answers

There are common questions as follows on the method of measuring operational risks. Answers to these questions are summarized below. More details are presented in a later section “Questions & Answers” of this paper.

(Applicability of VaR Method to Operational Risk Measurement)

- (A) Since operational risks include various risks, is it possible to apply VaR method to operational risk measurement in a uniform way?
 - Direct losses related to events of operational risks could be measured with Statistical Measurement Approach for VaR, while indirect losses or potential losses could be calculated with Scenario Analysis.

- (B) Since operations risk related to mental status and/or intentions of employees seems to be subjective, is it possible to measure it objectively?
 - While mental status and/or intentions can not be captured objectively, events of losses stemming from human behavior can be captured and measured objectively in terms of VaR.

(C) Is it necessary to measure and analyze causes of operational risks?

- Since causes are not always captured objectively, events instead of causes are focussed in measuring VaR in order to allocate economic capital to operational risks. On the other hand, it is necessary to analyze causes in order to enhance risk management.

(Robustness of Measurement)

(D) How to conduct back-testing of operational risk measurement?

- There could be two ways in validating operational VaR method. One is back-testing and the other is statistical test. While it may be difficult to conduct back-testing owing to data availability compared with market risk, it is possible to secure robustness of operational risk measurement with statistical testing. It is also possible to secure conservativeness of the measurement using interval estimation instead of point estimation.

(E) How to deal with high severity/low frequency events³?

- To measure them properly, appropriate distribution function with long/fat tails can be chosen with statistical method such as goodness-of-fit test. In addition, external data could be adjusted in accordance with internal loss data. This adjustment enables banks to focus on high severity/low frequency event.

(F) When there is correlation between operational risks, how can this correlation be identified and measured properly?

- More sophisticated techniques such as multivariate frequency distribution functions analysis may be needed with sufficient data. For the time being, some banks assume statistical independence or perfect correlation. In either case, Scenario Analysis may be used to examine sensitivity of the estimation to changes in the assumptions in order to check the robustness of models in stress situations.

³ In this paper, events mean 1) cases with intention such as rogue trade and/or theft, and 2) accidents such as transaction errors.

(Measurement as Management Tools)

(G) Is it cost-effective to measure operational risks?

-- Measuring operational risks enables banks to allocate resources in more cost-effective way. The cost to measure operational risks, which is declining owing to IT development, should be compared with such gains.

(H) How can VaR figures be used in enhancing operational risk management?

-- With VaR method, allocation of resources becomes more effective since it puts priority on each loss type in each business line for enhancing daily operational risk management and for conducting internal audit in more risk-focused manner. With Scenario Analysis, potential losses can be measured so that those contingency plans are addressed in order to minimize potential damages in the case of their occurrence.

2. Loss Data Collection

(1) General Comments

The authors can share the comments from banking and related industries that establishing robust loss data base (both internal and external loss data) is very important in measuring operational risks in a credible manner.

Comments from the industries indicate the followings.

(a) Some internationally active banks can manage these issues very well. An increasing number of banks are on the way of enhancing loss data collection for not only measurement of VaR but also for robust risk management in order to put priority on risk categories in each business line. It is expected that these movements encourage banks to upgrade operational risk management quantitatively and qualitatively.

(b) Challenges are how to use external loss data in order to supplement internal loss data. It is found that some international trends on loss data consortium have started to share banks' loss data, which will enable member banks to use external loss data.

(2) Summary of Questions & Answers

Questions are related to the following issues. Answers to these questions are summarized below. More details can be found in a later section “Questions & Answers” of this paper.

(Importance of Internal Data Collection with Strong Management Leadership)

(I) How to avoid business manager’s possible incentive to hide the events with losses when they fear some kinds of penalties?

-- It is necessary to have strong leadership of senior managers in collecting loss data. Actually, with this leadership, some internationally active banks successfully use such functions and procedures as 1) independent risk management section, 2) appropriate internal rules and 3) internal/external auditing in a risk-focussed manner.

(Dealing with Operational Loss Data related to Credit or Market Risk)

(J) How to deal with operational loss data related to credit or market risk?

-- In practice, operational loss data related to credit risk such as documentation errors of collateral agreements could be classified as credit risk. It is important to classify each loss event as certain risk category in a uniform way in accordance with internal rules in order to avoid double calculation or omission.

(Corresponding to Changes in Operations Procedures and to New Businesses)

(K) When banks change operations procedures according to IT development or address new business, is it appropriate to use past data?

-- It seems that these issues are not unique to operational risks but common to credit or market risk. Thus, the experiences in the field of credit or market risk are useful. As for changing operations procedures, the recent data could be more useful than the data in the long past, as are the experiences in the field of market risk. With regard to addressing new businesses, external data can be used as supplements.

III. Questions & Answers

1.Measurement Methods

(Applicability of VaR Method to Operational Risk Measurement)

(A)Scope of Measurement

Question:

There are risk managers who have reservations to the applicability of VaR method to operational risks because these risks include various risks such as operations, system, legal, reputational and business/strategic risks. How to measure these kinds of risks in a uniform way?

Answer:

It is important 1) to identify these various risks in each business line exhaustively and exclusively in order to avoid omission or double calculation of operational risks, and 2) to allocate economic capital to operational risks with appropriate measurement methods.

It is found that any operational risk could be measured in the following way.

- (a) Operational VaR can be measured with Statistical Measurement Approach if direct losses are focussed in terms of frequency and severity of events related to operational risks. This method is consistent with that of market or credit risk.
- (b) Indirect or potential losses⁴ could be captured with Scenario Analysis based on assumptions on frequency and severity for each scenario of events. This approach can be compared to stress testing in the context of market or credit risk measurement.

⁴ Potential losses are defined as events which do not occur according to a bank's own loss history, but have possibilities to take place according to, for example, peer banks' loss history and/or extreme loss event cases in the past.

Table1: Operational Risks with or without Events and Correspondent Measuring Methods

Operational Risks with or without Events		Measurement Methods
With Events (Including Near misses ⁵)	Direct Losses	Statistical Measurement Approach
	Indirect Losses	Scenario Analysis
Without Events (Events Occurred in Peer Banks)		Scenario Analysis

With regard to business/strategic risk, it is understood that after the Board of Directors and senior management make business decision on, for example, starting new trading products such as emerging market currencies, this decision brings about new exposure of market risk as a result. In other words, this business/strategic risk could be measured through market, credit or operational VaR measurement after business/strategic decisions of management are made. Scenario analysis can be used if business/strategic risk causes indirect losses as stated above.

(B) Measurability of Human-related Issue

Question:

It is not practical to measure operational risks in a statistical way because operational risks include those risks that are predominately people driven. How would it be possible to measure these kinds of risks objectively?

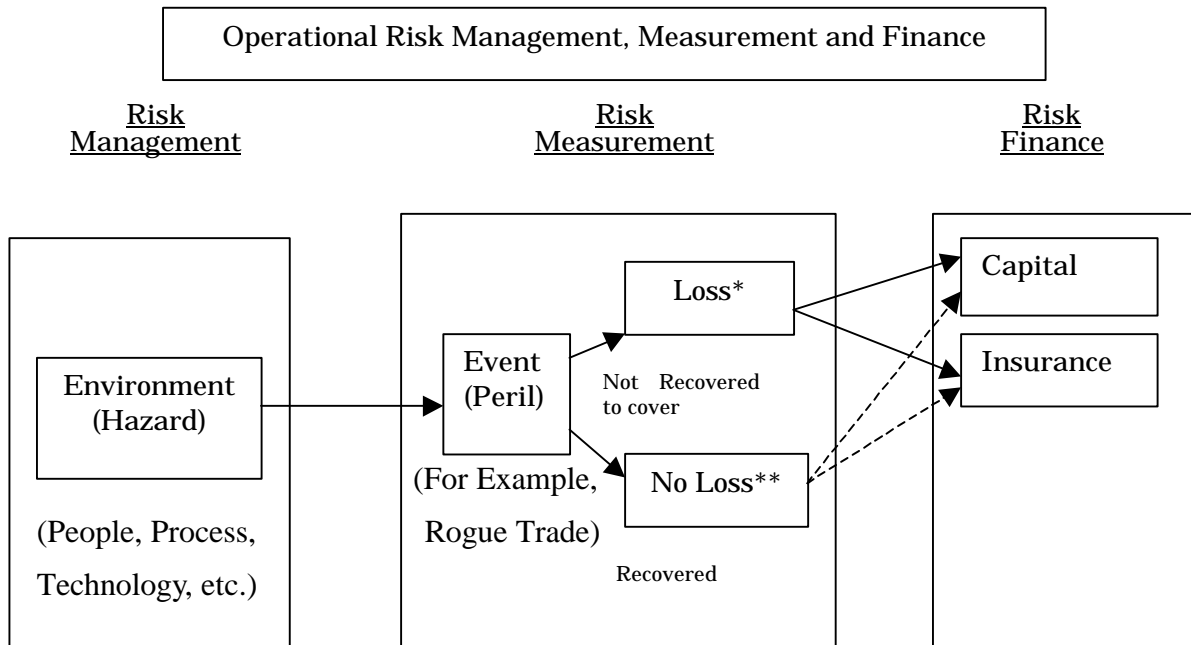
Answer:

This question is based on an argument that operational risks are brought about by human being whose behavior could be subjective, depending on his or her mental status. For example, rouge trade would be intended by an unfaithful trader. Another example is that foul mood of a clerk would cause transaction errors. It is also argued that operational risks can not be analyzed in an objective way or with statistics. Human behavior may be capricious and/or volatile.

However, this human behavior causes such events as rouge trade and transaction errors, which can be captured and monitored in an objective way. Since these events could

⁵ Near miss is defined as the events which do not incur actual losses. With this definition, near miss could be considered as losses with zero amount. Please also see the chart of (B) Measurability of Human-related Issue.

result in operational losses, these events could be handled with Statistical Measurement Approach, with statistical tests in an objective and robust way. Actually, a number of major banks are currently using this kind of approach and an increasing number of banks are actively developing it. This explanation is based on insurance theory (hazard-peril-loss relationship) and can be illustrated as follows



* Loss data are collected in terms of gross loss amount; for example, in the case where U.S.\$1,000 gross loss covered by U.S.\$700 insurance brings about U.S.\$300 net loss, U.S.\$1,000 gross loss is used as a loss data for Statistical Measurement Approach.

** “No Loss” or near miss is considered as event with zero loss amount and counted as frequency in measuring operational VaR. In this sense, “no loss” or near miss affects risk finance such as capital and insurance.

(C) Causation

Question:

Any event related to operational losses has its cause(s). For example, there are various causes related to human being, procedures, systems and external factors. Is it necessary to quantify and analyze these causes in measuring operational risks?

Answer:

As for risk management, there are two purposes. One is measurement of operational

risks to allocate economic capital (please see “Questions and Answers (H): Applicability of VaR method to Operational Risk Management”). The other is analysis of causation for operational risks to be used for loss prevention.

With regard to economic capital allocation, Statistical Measurement Approach is a method by which risk managers would calculate economic capital to operational risks with VaR method precisely. This approach enables Board of Directors to allocate resources properly. It directly focuses on events related to operational losses themselves.

On the other hand, regarding analysis of operational risks, it is necessary to identify and monitor causes of operational risks for enhancing risk management. Once business line managers identify and monitor causes of operational risks, they can manage operational risks effectively. In analyzing causation, it is possible to use causal model, which captures cause of operational risks explicitly, instead of Statistical Measurement Approach.

(Robustness of Measurement)

(D) Validation

Question:

Back-testing is very difficult since operational risks include events with low frequency. Therefore, it is almost impossible to conduct back-testing, which is very common method in validating VaR in market risk. How would it be possible to validate operational risk measurement?

Answer:

There could be two ways in validating operational VaR method. One is back-testing and the other is statistical test. In the operational risk management, statistical testing would be considered more useful than back-testing, because back-testing may not always be practical due to availability of data in some business lines.

In order to validate operational VaR with Statistical Measurement Approach, statistical tests on robustness of probability distribution functions can be used. At first,

appropriateness on the choice of distribution functions itself is needed to be checked with goodness-of-fit test. Then adequacy of parameters must be checked with interval estimation method in parametric statistical approach⁶.

(E) Treatment of High Severity/Low Frequency Events

Question:

It seems that Statistical Measurement Approach mainly covers low severity/high frequency events, while it should also focus on high severity/low frequency events. How can the latter events be dealt with appropriately?

Answer:

This issue is how to measure the shape of the tail of the loss distribution function precisely, since high severity/low frequency events could be located at the far right end of the operational loss distribution function. To measure them properly, appropriate distribution function with long/fat tail can be found and statistical testing such as goodness-of-fit test of distribution function can be conducted. External loss data can be used as supplement to internal data.

For example, some major firms have developed methods to map external loss data into internal data. In this mapping process, an external database could be used with ample events and loss data for each business line/loss type. External data could be adjusted in accordance with the size of the user bank and mapped into an empirical distribution of the internal loss data of the bank. This adjusted distribution function, which is known to have very long/fat tail, enables banks to focus on high severity/low frequency events.

(F) Correlation between Operational Risks

Question:

If there is correlation between operational risks, how can this correlation be identified and measured properly?

⁶ In stead of this parametric statistical approach, if banks use non-parametric statistical approach, in which histograms of frequency and severity of events are directly used to measure VaR, interval estimation of VaR must be conducted in order to ensure this approach of VaR measurement.

Answer:

It would be difficult to measure this type of correlation directly with statistical methods. It is needed to have more sophisticated techniques such as multivariate frequency/severity distribution functions analysis with sufficient loss data.

For the time being, some banks assume statistical independence among loss data within business lines/risk categories or across business lines/risk categories. In this case, Scenario Analysis may be used to supplement Statistical Measurement Approach so that the Board of Directors can see the impact of correlation of losses on economic capital.

On the other hand, risk managers may add up an original loss data and derived loss data into a single loss data from their empirical studies. In this case, perfect correlation between related loss events is assumed in a conservative manner.

(Measurement as Management Tools)

(G) Technological Threshold/Cost Effectiveness

Question:

Since operational risk measurement based on a detailed mathematical modeling technique would be highly advanced, IT equipment for operational VaR measurement may be very costly. Would it be cost effective to measure operational risks?

Answer:

Mathematical technique is not necessarily so advanced in measuring operational risks with Statistical Measurement Approach.

For example, risk managers in a major bank have developed a VaR model by themselves. Owing to recent developments of IT, spreadsheet enables them to use Poisson/normal random number generator, exponential function, and a programming language for general purpose.

Another example is that a risk management group in another bank has saved cost in developing VaR model by making necessary refinement to their credit VaR model, instead of making operational VaR model from scratch. Staff of the group argued that

frequency of events related to operational risks was similar to Probability of Default and that severity was akin to Loss Given Default⁷.

It is needless to say that sufficient validation or statistical testing of VaR needs to be conducted before using it for risk management in practice. For this purpose, it is necessary to have intermediate knowledge about mathematical statistics including probability theory, theory of statistical tests, and point and interval estimation methods.

Authors recognize that it is very important to develop robust database on events, losses and material risk drivers with Management Information System (MIS). Developing MIS could be costly. However, it is necessary for, in particular, internationally active banks to have robust MIS in order to enhance operational risk management.

(H) Applicability of VaR Method to Operational Risk Management

Question:

Supposing that it is possible to measure operational VaR, is it possible to use VaR in enhancing operational risk management? How to use VaR as management information?

Answer:

Major banks regard operational risk measurement as useful tool not only for capital allocation but also for enhancing risk management.

For example, with VaR method, effective allocation of resources becomes possible. This is because it would make possible to identify what kind of loss type and business line is most material so that the Board of Directors and senior managers will be able to realize those factors. With this information, they put priority on loss type in each business line for enhancing daily operational risk management and conducting internal auditing in more risk-focused manner.

Another example is that, with Scenario Analysis, handling such operational risks that have little or no loss data available on internal database becomes possible. In this case,

⁷ This analogy originating from a credit risk measurement method has been used and sophisticated in an operational risk measurement method, or what we call “Internal Risk Based Approach”. Please see the Working Paper Series No.2 “ Internal Risk Based Approach - Evolutionary Approaches to Regulatory Capital Charge for Operational Risk - ”.

it is possible to assess the impact of potential loss events on allocation of economic capital with various loss scenarios. It should be recalled that banks used this analysis commonly in setting up contingency plan for Y2K problem in order to make potential damages become minimized in the case of their occurrence.

2.Loss Data Collection

(I) Importance of Internal Data Collection with Strong Management Leadership

Question:

There could be the cases where business line managers have some incentives to omit reporting on the losses to risk management sections. How to prevent these problems?

Answers:

It is needless to say that accumulating internal loss data in different business lines is important. However, in this case, business line managers might have some incentives to omit reporting on the losses to risk management sections. Thus, it is necessary to have a very strong leadership of senior management in collecting loss data so that business line managers can put priorities on data collection.

The followings are important processes of data collection.

- (1) The independent risk management section, or middle office, should be in charge of collecting loss data.
- (2) Rules on reporting events are set up.
- (3) Independent internal/external auditing should be secured.

(J) Dealing with Operational Loss Data related to Credit or Market Risk

Question:

There are operational loss data related to credit or market risk. For example, loss case of default in credit files owing to imperfect hypothecation on collateral can be seen. This is partly due to operational and/or credit risk. How to distinguish operational risks from credit or market risk?

Answer:

In practice, loss in this example could be classified as credit risk. It is important to

classify each loss event as certain risk category in an identical way to avoid double calculation or omissions. In other words, boundary of risk category must be secured in any case.

With this strong boundary of risk category, in more rigorous way, these losses could be regarded as losses related to operational risks. This is because these losses do not stem from credit risk of borrowers but from operational risks. These losses could have been avoided if the operations in making hypothecation agreement had been properly managed.

These losses, which may be viewed in terms of credit or market risk, should be rather regarded as operational risks if their operations are not properly managed in accordance with internal rules or industrial operation practices. These classifications of loss data could be useful not only in enhancing robust loss database but also in improving operational risk management.

(K) Corresponding to Changes in Operations Procedures and to New Businesses

Question:

Banks might change operations procedures or transaction flow of back offices substantially in accordance with the recent development of IT. In addition, banks might participate in new businesses such as Internet Banking business. How can past loss data be used in these cases?

Answer:

It seems that these issues are not unique to operational risks but common to credit or market risks. Thus, it is expected that these experiences and analogies to credit or market risk measurement could be utilized to handle this issue.

As for substantial changes in operations procedures or transaction flow of back offices, the recent loss data could be more useful than the data in the long past. This is the same idea in the market risk measurement where the recent data are more important in the case of market environments changing very rapidly.

In addressing new businesses, external data comparison method would be used. For example, if there are other banks operating the same kind of business, external data obtained from these banks could be supplemented for Scenario Analysis.

In any case, this issue is the matter of time lag in the sense that as time goes by, loss data could be collected and measured with Statistical Measurement Approach.