

## Operational Risk Modeling\*

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**Abstract.** *Losses resulting from operational risk events from a complex interaction between organizational factors, personal and market participants that do not fit a simple classification scheme. Taking into account past losses (ex. Barings, Daiwa, etc.) we can say that operational risk is a major financial losses in the banking sector, although until recently have been underestimated, considering that they are generally minor, note setting survival of a bank.*

**Keywords:** operational risk; BIA; SA; AMA; LDA.

**JEL Codes:** D53, G32.

**REL Codes:** 7J, 11B.

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Because of the financial crisis and prolonged recession economics European Supervisory Organizations, banks feel inadequate capitalization required by the Basel I and II, which cannot absorb the consequences of banking risks and ensure economic development through credit, so they created new complex prudential policies, grouped under form a new agreement, namely Basel III.

Such rules and regulations have been created which has recognized the impact of operational risk in credit institutions, consistent with changes occurring within the banking and financial market, stressing the importance of proper risk management, without which financial institutions cannot exist.

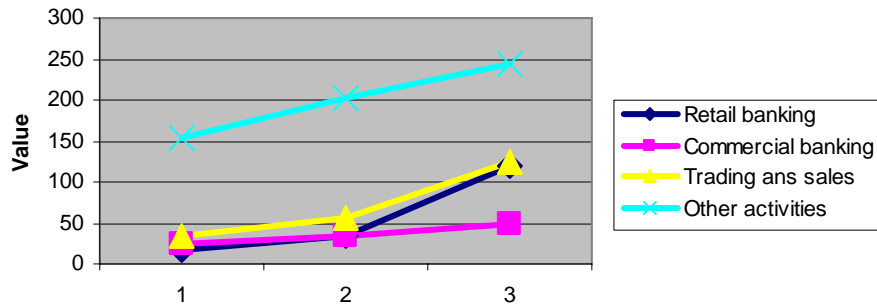
Identify risk issues and capital adequacy of credit institutions and investment firms have been given increasing importance of large, both internationally and nationally, such that different models have been developed for quantification and operational risk management. Through this study we proposed: identification and analysis of operational risk, highlighting the applicability of capital adequacy models, and determining capital requirements for credit institution in Romania.

For the first pillar of Basel II on the minimum capital required to cover operational risk, in what follows we present the case of a credit institution, hereinafter named financial institution X, aiming to ensure the confidentiality of information provided. The database contains all relevant information in terms of operational risk and includes 2650 observations.

The concept of credit institution analyzed the relevant indicator is called “gross income”, which is the sum of the profit and loss account of net interest income and similar income from shares and other variable income securities, with commissions income, income from financial operations and other operating income.

As the main business lines the credit institutions considered for the analysis of losses from operational risk: trading and sales, retail banking, commercial banking and other activities (which includes overlapping corporate financing activities, payment and settlement services as agent), classification of operations performed on the basis of specific criteria and policies developed and implemented in internal procedures.

For all business lines the financial institutions have used as relevant indicator the “gross income”, considering it, according to the Basle Committee and recommendations, a clear indicator present in annual financial statements on which the calculations can be performed easily and national comparisons and international are easily audited and reflects very well the sensitivity of operational risk.



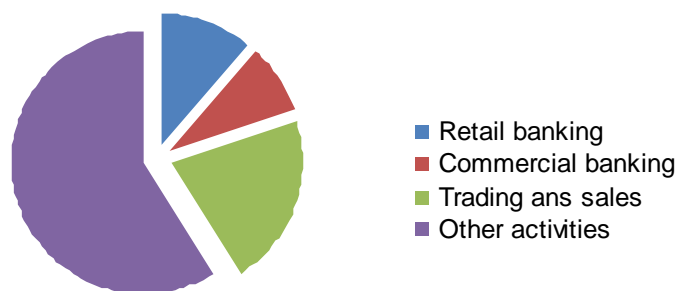
Source: authors.

**Figure 1.** Evolution of gross income for the business lines

To obtain high values for a particular business line shows the size and intensity of activity gross income of the institution concerned on those industries, also providing information about the departments concerned with potential losses that may occur and the amount necessary to cover losses related to operational risk business lines.

To determine the capital requirements for operational risk under the basic approach is to apply factor 15% of average gross income received by each credit institution over three consecutive years.

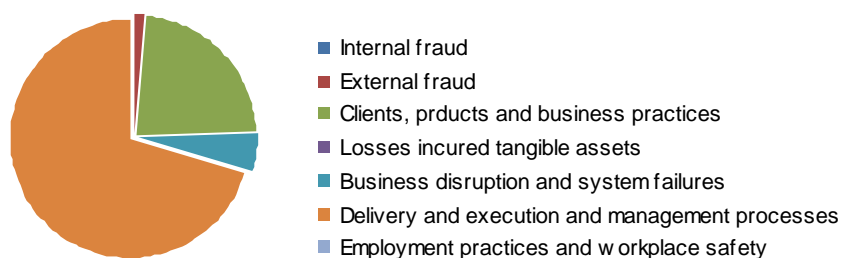
Where the standard model for determining the capital requirement should be started the process of allocating gross income for each business line as can be seen from Figure no. 1. Then the average gross income for each business line will apply the appropriate risk weight to calculate the capital requirement.



Source: authors.

**Figure 2.** The capital requirement under the standardized approach to business lines

The credit institution has allocated the largest share of capital for operational risk business lines: financing companies, payments and settlement, agency services, retail brokerage, asset management, is considered the most risky, but according to Figure 1 we interpret that this allocation is due to the fact that the lines are most active in terms of obtaining income. Losses arising from operational risk, where the credit institution are identified and related international standards on the seven types of events, such as internal fraud, external fraud, employment practices and workplace safety, clients, products and business practices; incurred losses of tangible assets, business disruption and system failures and execution, delivery and management processes. Thus on the basis of documents centralized accounting department, internal audit, IT, risk management, operations department, the Department of Operational Risk losses and the situation may types of events causing losses for the financial institution, which we present in the figure below.



**Source:** authors.

**Figure 3.** *The probability of occurrence of events per event type*

For the credit institution the most frequent losses were due to management processes, poor execution or distribution due to a lack of documents, incomplete documents, lack of customer permission, shipping losses, collateral damage management, bad communications, maintenance, or discharged with errors, accounting errors, missed deadlines or responsibilities expired, the collateral maladministration, negligence or loss generating assets endangering the customer, unauthorized access to the accounts, records, customer errors, inaccurate reporting, error reporting etc. obligations.



Source: authors.

**Figure 4.** *Operational loss suffered by event type*

For credit institution main loss in terms of severity is due to the destruction of physical assets as effect of deterioration or loss of physical assets of the organization and their impact on business. Analyzing Figures 3 and 4 can easily establish internal fraud and lack of employment practices and workplace safety that might explain with efficient management of the financial institution. Next to the credit institution will apply the method analyzed Loss Distribution Units (LDA) for measuring capital requirements for operational risk.

Financial Institution Activity was divided, as in Standardized Approach, in four business lines, as presented and the Basel Committee, namely: Retail Banking, Commercial Banking, trading and sales, other.

Using the model to classify all types of events provided by the Basel Committee, in the work were encountered losses due to internal fraud, external fraud, risks arising from relationships with customers, products and business practices, destruction of tangible assets, adjournment operations or errors in the system, process management, execution or faulty distribution, staffing and related conditions workplace safety.

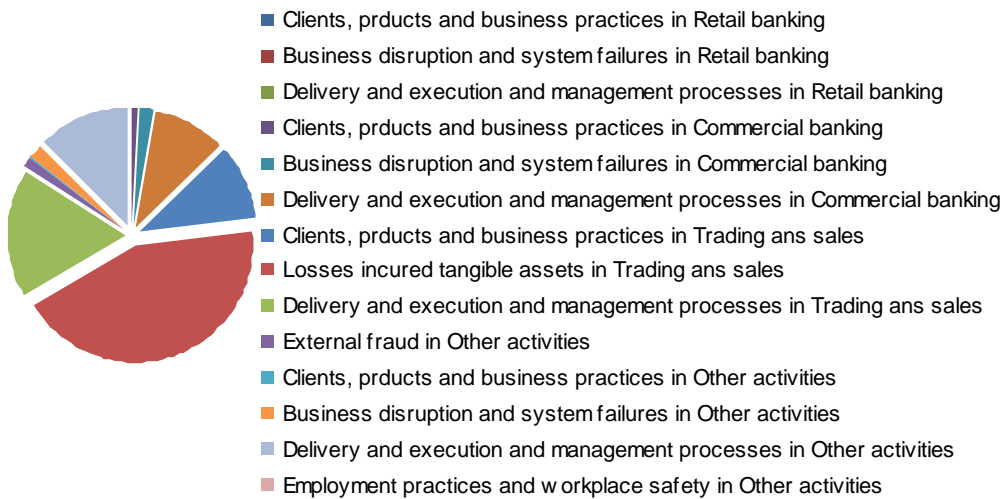
This will result in 28 cells of the matrix types of events/lines of business. The first step of this method is to assign the number of losses suffered by the credit institution in each cell of the matrix.



Source: authors.

**Figure 5.** *Number of losses suffered by the credit on each cell of the matrix*

After distributing the number of cell losses, the losses are distributed over the cell matrix.



Source: authors.

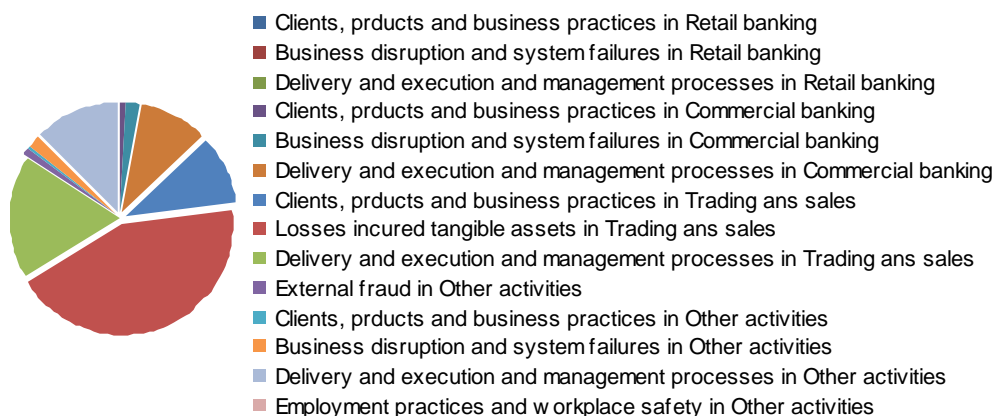
**Figure 6.** *The losses incurred by the credit on each cell of the matrix*

Frequency distribution is a discrete one data and having information on a relatively short period of time, it will be modeled by Poisson distribution (Frachot, 2001), setting its parameters so as to provide the average number of incidents occurred for the period.

In case of the severity distribution, being a continuous and positive, there were tested several distributions such as Gamma, Exponential, Logistic, LogLogistic, Normal, log normal, Pareto, Weibull, choosing Weibull distribution, in most cases Exponential and lognormal ones considered as the closest to the empirical distribution.

Using Monte Carlo simulation for the aggregation of severity and frequency distribution there were simulated 100 scenarios of occurrence of these losses, including 10,000 each scenario values.

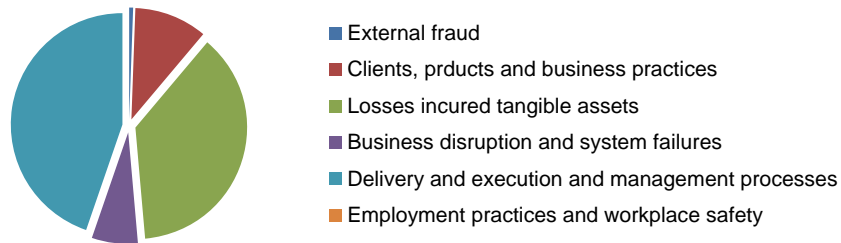
Operational risk capital requirement for credit institution will be determined like value at risk, being the total value at risk for each cell of the array of risks; confidence interval was set at 99.9%.



**Source:** Own processing.

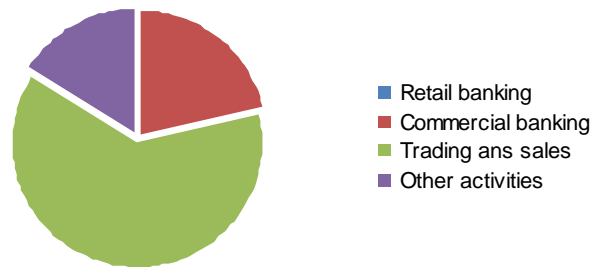
**Figure 7.** *The expected loss on business lines and event types*

Next we determine the expected loss event types and business lines, summarizing the results in Figures 8 and 9 respectively. Thus the most common expected loss is due process management, poor implementation and distribution, and the most affected line of business is the trading and sales.



Source: authors.

**Figure 8.** *Value at risk by types of events*

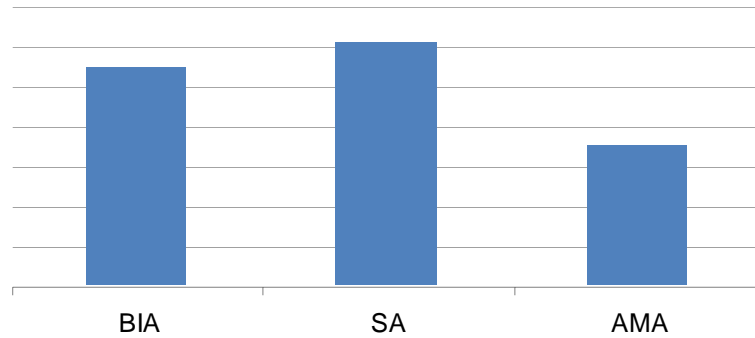


Source: authors.

**Figure 9.** *Value at risk business lines*

Thus summing up the institution's credit analysis, we observed, as from Figure 10, that once the bank uses a more complex means of measuring operational risk, capital requirement for this risk is reduced. Minimum capital is allocated using the Distribution Approach loss because it can identify, measure and manage operational risks more effectively. One can easily observe the superiority of advanced methods, achieving a substantial saving of capital for operational risk, when using advanced methods.





**Source:** authors.

**Figure 10.** *Capital requirement determined using three approaches*

In case of the credit institution is remarked an increase of the capital requirement when used the standard method because the most active business lines are the trading and sales and other activities whose risk weight is 18%.

In this paper there were used original methods and designs, prepared according to available data, supporting the need for operational risk and capital adequacy measurement own funds continues to expected or unexpected events related to credit institutions. The biggest problem encountered in applying the model was the small number of observations for certain types of events and business lines, as data collection is realized over a threshold established by the credit institution as a balance between small losses and the cost of registration accuracy losses too large a boundary situation. Another problem may be created by the consistency, relevance and bias estimates where quantitative methods are applied on irrelevant data, poor quality or too expensive. VaR method is applied with difficulty due to the identification of structural dependence, between risks, estimation, tests and procedures used to construct an increasing number of functions. Identify inconsistencies may occur due to operational losses level: different accounting standards and practices, lack of regulations regarding the inclusion or exclusion of some components of losses in capital base required, etc.

Such financial institutions may suggest that the first step would be to do the measurement of operational risk is to conduct an inventory by category and creating a methodology to identify, plan and avoid these risks and devising plans for crisis and address the effect of event risk.

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