# OPERATIONAL RISK AND ITS IMPACTS ON FINANCIAL STABILITY

Věra Mazánková and Michal Němec, CNB

*This article illustrates the nature and significance of operational risk with regard to financial stability, using specific examples of major operational risk events in the Czech Republic and in other countries, and identifies the impacts of the newly introduced capital regulation of operational risk. It looks in detail at the incipient practice of risk-sensitive operational risk measurement using methods based on financial institutions' internal models. We also explore the issue of calculating the mandatory capital coverage for unexpected operational risk losses using group-wide models.*

## 1. INTRODUCTION

January 2008 saw the introduction of a new obligation on all banks and credit unions and selected investment firms in the Czech Republic to ensure adequate capital coverage for operational risk in addition to credit risk and market risk. This requirement stemmed from the incorporation of Basel II – the new capital framework of the Basel Committee on Banking Supervision (BCBS) – into the European legislation and subsequently into Czech law.

This article sets out to clarify the nature, aims and practical forms of operational risk management and regulation and the implications for financial stability. In the individual sections we therefore describe:

- the key concepts, starting with the definition of operational risk and a description of its links to the principal financial risks, i.e. credit risk and market risk (section 2);
- the prudential requirements in the operational risk area and selected impacts thereof (section 3);
- the advanced approaches for operational risk measurement, emphasising the elements thereof having potential impacts on banks' capital adequacy and thus on their financial condition and stability, focusing specifically on the mechanisms for allocating capital to subsidiaries in the Czech Republic and on insurance as an important technique for mitigating operational risk in the banking sector (section 4).

## 2. OPERATIONAL RISK

Just as in any other field of business, factors such as people, internal processes, technological systems and external events play a key role in financial institutions. It is in the natural interests of every financial institution to ensure that such factors provide it with maximum support in achieving its business goals. However, these factors inherently involve various risks stemming from potential failures which can affect the operations and thus also the outputs and results of a financial institution.

This leads to the widely accepted definition of operational risk in the banking sector: **"Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events, including legal risk"**. This definition, confirmed by best practices,[145] is usually followed immediately by an explicit statement that operational risk excludes strategic and reputational risk.

As is evident from its definition, operational risk, unlike the key financial risks (credit risk and market risk), is not linked primarily with a financial institution's portfolios (credit, trading, investment), but instead relates to its processes and operations and the main elements thereof – people, systems and technology.[146]

145 Seven basic types of loss events, or areas of occurrence of operational risk, have been pinpointed from previous best practices: (1) internal fraud, (2) external fraud, (3) employment practices and workplace safety, (4) clients, products and business practices, (5) damage to physical assets, (6) business disruption and system failures, (7) execution, delivery (including outsourcing) and process management.

146 Under the regulatory rules, events having the character of operational risk associated with market or credit activities, such as credit fraud, exceeding of trading limits, legal shortcomings in the contractual guarantees of receivables, damage resulting from professional shortcomings in the preparation of new products, programme deficiencies, valuation errors, etc., are also deemed part of operational risk monitoring.

Owing mainly to events such as 9/11, the collapse of energy giant Enron, the rogue trading of a "lone wolf" currency trader at a U.S. subsidiary of Allied Irish Banks and the subsequent failure of that subsidiary, and the recent events at Société Générale, it is no exaggeration to say that literally everyone now has a basic, or at least intuitive, awareness of operational risk in the financial sector. It is also clear that operational risk events can also significantly affect the reputation, risk profile and financial standing of an institution, as illustrated by the examples of operational risk events given in the following table.

**Table 1 – Selected operational risk events around the world and in the Czech Republic**

| *Cause - Event (Institution)* | *Impact[1)] / Year* |
|---|---|
| Cheque fraud (group of U.S. retail banks) | $12,000 m / 1993 |
| Failure to ensure segregation of operations – fraud (Barings) | $1,600 m / 1995 |
| Insider trading (Merrill Lynch) | $100 m / 1997 |
| Inadequate trading limits and controls (Nomura Securities) | $48,000 m / 1998 |
| Misuse of client accounts by bank employees (ABN AMRO) | $140 m / 1998 |
| "Computer" fraud by employees (WGZ Bank) | $200 m / 1998 |
| Credit fraud by client – forgery of loan documents (Citibank) | $30 m / 1999 |
| Auction system failure (Ebay) | $5,000 m / 1999 |
| Terrorist attack on World Trade Center (WTC) | [2)] / 2001 |
| Rogue trading (Société Générale) | $7,300 m / 2008 |
| CR[3)] – Credit fraud - B.C.L. case (KB) | up to $180 m / 1999 |
| CR – Non-compliance with dealing procedures (ČSOB) | $35 m / 2001 |
| CR – Floods (numerous financial institutions) | [4)] $2,100 m / 2002 |
| CR – Sporoservis failure – credit fraud (ČS) | $40 m / 2006 |
| CR – Cash theft at agency providing services mainly to financial institutions | $30 m / 2007 |
| CR – Fee rounding errors in IT system (KB) | $10 m / 2007 |

1) Amounts converted at exchange rate valid at time of occurrence or discovery of event.
2) Published estimates of impacts vary.
3) Sources of information on events in Czech Republic (in same order as in table): Hospodářské noviny (HN) 27 February 2008, HN 6 December 2001, Mladá fronta (MF) 24 February 2003, MF 5 April 2006, HN 4 December 2007, Euro 28 January 2008.
4) Figure for Czech Republic as a whole, institutions and households.
Sources of information on events outside Czech Republic: Operational Risk Magazine, Risk Magazine, Incisive Media Ltd., UK.

The growing media coverage of the events mentioned here and of similar events has also encouraged more comprehensive awareness and analysis. This has gradually led to a higher degree of systemisation of the operational risk management approaches used by businesses, their regulators and supervisors and by other institutions specialising in financial system soundness and stability. The causes and nature of operational risk events, however, have a history as long as the finance business itself. The well-known tools and processes widely used in practice to **prevent or limit operational risk events and mitigate their impacts** also remain similar. Examples include the segregation and restriction of decision-making and executive processes and powers, screening of fitness for certain professions, various checks and balances, security and management of access to information and other assets, mandatory testing and backing-up, contingency and crisis planning, as well as the creation of budgetary and other internal provisions for operational losses and various types of insurance.

So, as far as the rather abstract concept of operational risk is concerned, we are talking not about a "newly discovered" risk, but rather about its newly emerging manifestations – for example operational risk associated with outsourcing or with the electronic distribution of financial products and services. We can also say that higher quality (more systematic and comprehensive) and more sophisticated operational risk management methods are now being applied. Financial institutions are gradually introducing **integrated operational risk management systems** that conform to best practices. At the same time such systems are helping these institutions to comply with the recently introduced mandatory regulation of operational risk.

## 3. REGULATION OF OPERATIONAL RISK

### 3.1. Operational risk management

As with other risks, managing operational risk involves defining an institution's overall approach to the risk and operating appropriate internal systems and processes. These systems and processes should ensure that operational risk is identified, assessed, monitored, declared and controlled and/or mitigated. Operational risk mitigation techniques include ensuring adequate capital coverage for unexpected losses (see section 3.2.) and alternatively taking out commercial insurance.

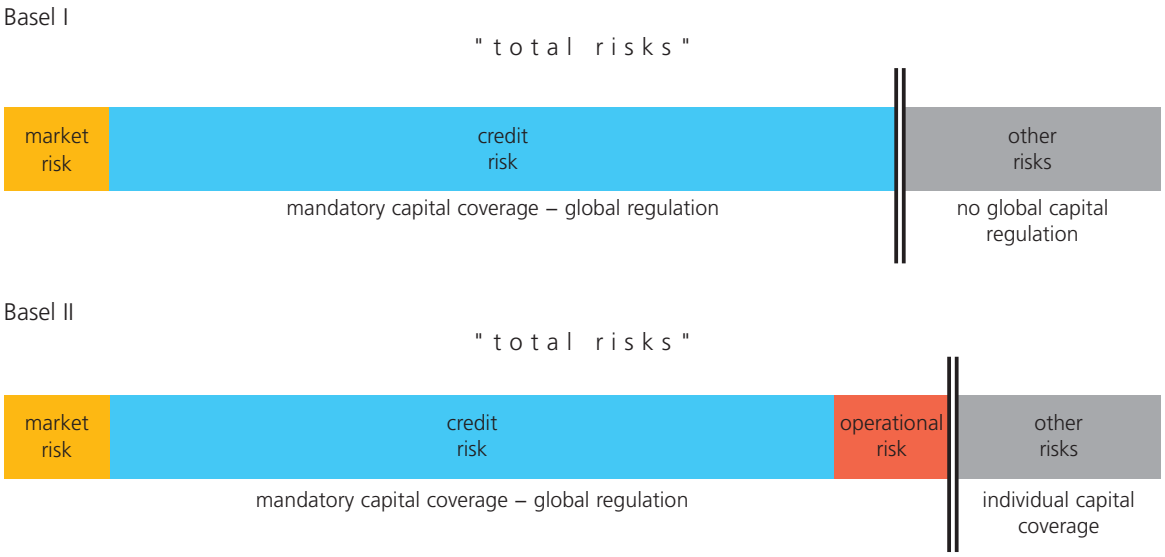
From the operational risk management perspective, it is desirable to pay attention – among other things – to operational risk events that do not have a direct financial impact. For example, the attempt by two Czech businessmen to commit a credit fraud with a calculated potential impact of $3,500 million against a well-known Swiss bank (2006)[147] illustrates just how well-founded this requirement is.

The following four key principles are widely regarded as essential for a sound and effective operational risk management system:[148]

- the creation and development of an appropriate permanent environment (framework) for the systematic management of operational risk;
- the introduction and application of efficient and effective firm-wide and specialised operational risk processes and tools, including adequate capital coverage for unexpected losses due to operational risk;
- independent internal and external review and assessment of operational risk management;
- transparency, i.e. disclosure of information on operational risk and operational risk management.

### 3.2. Capital regulation of operational risk

As mentioned earlier, one of the key operational risk management tools is to maintain adequate capital coverage for unexpected losses due to operational risk. Apart from recommended[148] individual operational risk capital coverage, operational risk now ranks alongside credit risk and market risk as one of the three risks with mandatory capital regulation. The former (Basel I) and current (Basel II) breakdown of regulated banking risks is illustrated by the following diagram.




147 Hospodářské noviny, 7 February 2008

148 For more details, see, for example, *Sound Practices for the Management and Supervision of Operational Risk*, Basel Committee for Banking Supervision (2003).

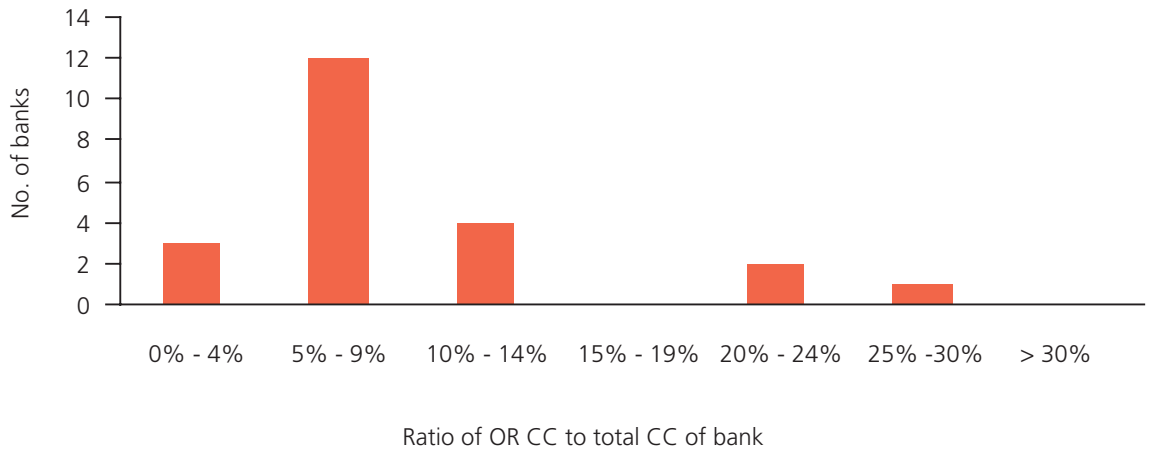
It is useful at this point to recall some of the basic requirements and aims of Basel II:

- one aim is to raise the quality of systems, processes and methods for risk measurement and management generally, leading eventually also to a reduction of the previous capital charges for credit and in some cases also for market risk, so that the total capital charge does not generally increase after incorporation of the new separate operational risk capital charge;
- institutions can choose from among at least three different approaches for determining operational risk capital charges, with the simultaneous use (combination) of various approaches permitted under certain conditions;
- institutions are not allowed to revert from a more advanced approach for determining operational risk capital charges to a simpler approach without good reason (in order to prevent any attempts at capital arbitrage);
- according to surveys (mostly conducted by the Basel Committee on Banking Supervision), the ratio of the new operational risk capital charge to the total capital charge is estimated at around 10–15% globally in the long term.

The impacts of Basel II on the Czech banking sector have also been estimated. According to the QIS 5 survey conducted in 2005, the ratio of the new operational risk capital charge to the total capital charges of banks in the Czech Republic was expected to be around 8%.

Real data on operational risk capital charges for the entire Czech banking sector are available from the start of 2008. The specific impact of the new mandatory operational risk capital charge on total capital charges is shown in the following chart.

**Chart 1 – Ratios of operational risk capital charge (OR CC) to total capital charges for the Czech banking sector as of 31 January 2008 (sector average: 10%)**




Source: CNB, 2008

The ratio of the operational risk capital charges to the total capital charges for the Czech banking sector as a whole was 10% at the start of 2008. This figure is broadly in line with the long-term estimates and predictions of the Basel Committee on Banking Supervision. So, compared to the surveys of the predicted impacts of Basel II in the Czech Republic conducted in 2005, the ratio of the operational risk capital charges to the total capital charges for the sector as a whole is around 2 percentage points higher (up from 8% to 10%). This increase is probably due mostly to an increase in the proportion of banks using the simplest – and hence the more capital-intensive – approach for determining the operational risk capital charge as compared to the proportion of such banks in the survey conducted in 2005.

Specifically, banks in the Czech Republic have the following categories of approaches available for determining their minimum operational risk capital charges:

- the Basic Indicator Approach (BIA)
- the Standardised Approach (TSA) or the Alternative Standardised Approach (ASA)
- the Advanced Measurement Approaches (AMA).

The first two approaches are based on the assumption that the size of operational risk (the exposure of the institution to operational risk) is directly proportional to the value of a particular indicator. The indicator is uniformly defined and based either on income (the BIA and TSA[149]) or on the volume of loans provided (the ASA). The capital charge corresponds to a fixed percentage of the value of the indicator (12, 15 or 18%). These simpler approaches are fully standardised, predefined and laid down bindingly and uniformly in the Czech Republic in a legal rule,[150] so they are not described in any further detail here.

The most complex and sophisticated approaches are those based on internal models (the advanced approaches, or AMA), which will be examined in more detail in the following section. Generally, the parameters of the AMA reflect the most advanced operational risk management and measurement practices and in this sense offer a guide for all banks.

## 4. THE ADVANCED APPROACHES TO OPERATIONAL RISK MEASUREMENT

The fundamental quantitative requirement for an AMA operational risk measurement system is that it must have the following elements: internal data, external data, scenario analysis and business environment and internal control factors. However, more detailed rules – defining, for example, how these mandatory elements should be incorporated into the AMA, how they should be combined and what weights they should have in the overall measurement of operational risk – are not laid down in the regulations.

Qualitative requirements are also defined for the AMA. Financial institutions' operational risk management systems and processes must comply with explicit "advanced" requirements. These requirements are in principle in line with internationally recognised best practices for operational risk management.

The most valued feature of the AMA is that the quantitative requirements (the main ones are described in more detail below) are relatively general, which means that institutions can use their tried and tested operational risk measurement methods. On the other hand, the generality and flexibility of the regulatory requirements may simultaneously be the biggest barrier to the use of the AMA, especially for smaller or less sophisticated institutions, as tried and tested methods that can be applied directly under the AMA have not been fully introduced yet.

Another feature of the AMA which is also appreciated in practice is that the regulations explicitly allow it to be developed and used on a group-wide basis, i.e. a common model can be created for an entire consolidated group, enabling the group to take advantage of the effects of spreading its operational risks. Consequently, the group model can be used for calculating the operational risk capital charge both for the group as a whole and separately for the individual members of the group. However, an allocation mechanism – whereby the capital charge is derived from the group calculation – is much more frequently used to determine the capital charges for the individual members of a group. As this approach is easily the most prevalent in the Czech Republic, it will be described in more detail in section 4.3.

The last specific feature of the AMA to be addressed in more detail in this article is the option of using operational risk mitigation techniques, most notably insurance, to reduce operational risk capital charges.

149 The standardised approach for calculating the operational risk capital charge is based on the assumption that operational risk exposure expressed by means of a universal income-based indicator depends additionally on the nature of an institution's business activities. For this purpose, bank's business activities are divided into eight business lines and three categories with a rising level of operational risk (the risk weight, referred to as beta, is given in parentheses): (1) retail brokerage, retail banking and asset management (12%), (2) commercial banking and agency services (15%), (3) corporate finance, trading and sales, and payment and settlement (18%).

150 Decree No. 123/2007 Coll.

### 4.1. Elements of the AMA

**Internal data**
Comprehensive information on individual operational risk events (in particular realised losses) is the cornerstone of operational risk management, and so all institutions should have such an overview no matter what approach they use to calculate their operational risk capital charges. If an AMA is used, this overview must include an appropriate valuation of the size of the losses ensuing from such events.

The most frequently used data collection system is based on correspondents, i.e. workers who are responsible, among other things, for collecting information on internal operational risk events and recording them in the relevant operational risk system or database. The information obtained is then used for further data analysis and, where relevant, for assessing specific events. This system, based on the collection of information "in the field", is more difficult to organise and more costly and often fails to ensure that data of the required completeness are collected. On the other hand, the advantages of this system are that it allows all event-related costs to be taken into account more accurately and it enables the institution to acquire and assess more operational risk information and events, including potential losses, indirect costs and events that do not lead directly to operational risk losses.

Another fairly frequently used data collection system is based on the use and analysis of accounting records. For this approach, the first step is to select the accounts on which operational risk events are or can be recorded. These accounts are then periodically analysed and any operational risk-related changes on them are transferred to an operational risk event database. The advantages of this approach are that it ensures more complete collection of events with an accounting impact, provided that due care is taken during the initial selection of the tracked accounts, and the data collection process is less costly. The weaknesses of this system compared to the previous approach are that a time lag may arise between the occurrence of an operational risk event and the date it is recorded in the accounts, there is a smaller amount of accompanying analytical information on individual events, and it involves the exclusive use of book valuation of individual events. This valuation method can be too inaccurate for operational risk management purposes, for example for events related to long term assets where the accounting depreciation does not reflect the true value of the asset in question.

With regard to the completeness, accuracy and timeliness of the information recorded, preference is given in current practice, including in the Czech Republic, to data collection systems based on a limited number of correspondents with subsequent checks of the completeness of recorded events with data in the accounting system; the size of the loss may differ for the reasons mentioned above (in such case the difference should be explained).

**External data**
External data are included in the AMA primarily to provide additional information on significant, yet infrequent operational risk events. The data are obtained, for example, from other institutions via membership in a consortium of institutions that pool information on internal operational risk events, via commercial databases or via internal event monitoring using the press or other public information sources (owing to increasing media coverage, the probability of catching a loss event rises with loss size).

One of the main ways of using external data in the AMA is to incorporate them directly into the internal data. With this approach, it is essential to ensure that the external data do not unduly skew the internal data distribution. Such skewness can have several different causes; for example, consortium or commercial databases only contain losses exceeding a certain threshold, and this threshold is usually higher than the one used for internal data. One possible solution to this problem is to compare the shape of the distribution of the internal losses in a risk category that can reasonably be expected to contain very severe losses with the external data distribution, and on the basis of that comparison eliminate the skewness of the external data in other risk categories.

Another very frequently used solution is to apply an appropriate scaling factor to the external data, i.e. to adjust the amount of the loss recorded by an external institution according to a factor available for one's own institution and an external one.[151] However, one should proceed with caution when scaling, because not every event type or

151 The indicators used for scaling include the ratio of total assets and the ratio of number of employees.

loss amount depends on such factors; for example, losses associated with human error in financial market trading or certain losses resulting from legal disputes are not necessarily related to institution size.

**Scenario analysis**
The incorporation of scenario analysis serves a similar purpose as that of external data. These two mandatory elements are meant to ensure that the AMA captures extraordinary events with very severe losses, events which – given the limited internal data time series used for modelling purposes – may not be recorded among the internal data. Unlike internal and external data, scenario analysis takes into account expert opinion regarding the potential future evolution of operational risk. As a result, it is possible to incorporate into the AMA potential "new" losses and other projected trends in an institution's operational risk exposure.

Given the aforementioned similarity of the reasons for including external data and scenario analysis, these two elements are often combined and incorporated jointly into the AMA. The classic example of this approach is the derivation of potential severe impacts in scenario analyses, where available external data are provided to the experts as a source of inspiration in their assessment. Even in this case, however, the experts must not ignore potentially severe loss types specific to the given institution.

**Business environment and internal control factors**
The last mandatory element of the AMA consists of methods for incorporating various changes in the business or internal control environment into the measurement. These methods allow an institution to adjust the capital charge calculated on the basis of the previous elements and thereby eliminate the shortcomings inherent primarily in the internal data (i.e. the assumption that past experience is the best tool for estimating future losses). By incorporating such factors, the capital charge can be reduced if, for instance, new control mechanisms are introduced which have a provable impact on the institution's risk profile. Or, conversely, the charge will need to be increased if, for example, there is significant increase in the institution's activities or it commences new operations or launches new products. This mandatory element, like scenario analysis, is meant to make a bank's risk measurements more forward-looking and allow it to take account of changes in qualitative factors.

For this purpose, key risk indicators are used most often in practice. They allow a bank to estimate the future level of the risks it undertakes. Examples include the number of particular transactions processed by a single employee and the number of open legal disputes. Although large sets of such indicators are mentioned in the literature, the number of risk indicators chosen as key indicators is usually in single or, at most, double figures. Determining the specific set of key risk indicators appropriate for a particular financial institution is therefore quite a difficult process and needs to take account of the institution's specific situation. Another potential tool for assessing changes in the control environment is the application of risk self-assessments, which involve contacting individual process owners tasked with identifying specific process risks, evaluating the adequacy of the existing controls and assessing the residual risks, i.e. those not captured by the controls already in place.

Both tools (risk indicators and risk self-assessments) require "backtesting" to assess the key indicators' risk-prediction ability or the experts' estimation accuracy in risk self-assessments. The predictions are also compared against the internal losses actually realised. Significant deviations should be recorded and explained and, where relevant, the use of these tools should be modified so as to ensure better agreement in future backtesting.

### 4.2. Combinations of mandatory AMA elements

**Internal data-based AMA – LDA model**
As for the methodology applied to calculate capital charges using the aforementioned AMA elements, the dominant approach currently used in the Czech Republic and elsewhere is based on the tracking of internal operational risk events and the subsequent derivation of a mathematical apparatus based on those internal data. This approach is known as LDA.[152]

If we have access to sufficient internal loss information of the required quality, we can create a model for estimating the total loss. Since, however, individual operational risk events are highly diverse, we first need to create a set of homogeneous data that can be expected to be based on the same statistical distribution. Although

152 Loss distribution approach.

this is not specifically required by the regulations, the data are often distributed into risk classes corresponding to the combination of seven event types[145] and eight business lines[149] (i.e. 56 risk classes in all). In this case, the events within each of these classes are regarded as events generated from the same distribution and less strict requirements are usually imposed on the statistical tests of the homogeneity of the data. However, since individual institutions (from the economic perspective fortunately) do not have enough data for statistical modelling purposes, selected risk classes are merged. For such mergers, tests have to be conducted to determine the homogeneity of the data in each risk class. In practice, one often encounters the solution where the data are split into categories according to event type and further broken down by business line for any categories containing a sufficient number of observations.

The estimation of the total loss in each risk class is given by the sum of independent, equally distributed random variables representing the individual loss amount. As the number of events is also a random variable, we are not talking about a deterministically determined number of summands. We are talking about a random sum where the number of summands corresponds to the realisation of a random variable with a discrete distribution. At the same time, independence between the number of events and the individual loss amounts is assumed.

A quantile (usually at the 99.9% level) is determined from the total loss distribution. This quantile forms the basis for the calculation of the operational risk capital charge.

In some cases this problem is not easy to solve, because it is difficult to fit the observed data using a theoretical distribution function matching the observed values sufficiently accurately across the whole range of losses. Therefore, combinations of several distributions or, for distributions of large losses, functions based on the theory of extreme values[153] are also used. Since the derivation of the theoretical distribution function of the random variable of the total loss is associated with various problems, Monte Carlo simulation is usually employed.

Given the aforementioned dominance of "group" AMAs, this part of the AMA is usually conducted only in parent institutions, i.e. outside the Czech Republic, and since the theoretical underpinnings of the models, including the methods for selecting suitable distribution functions and related tests and for calculating the total capital charge across the individual risk cells, are adequately described in various sources (see, for example, Cruz, 2002, and Moscadelli, 2004), no further space will be devoted to this issue here.

The aforementioned model incorporates internal data only. The other mandatory elements can be incorporated into the approach in several ways, but the authors have not noted any dominant approach that it would be useful to describe in this article.

**Scenario analysis-based AMA – SBA model**

To the best of the authors' knowledge, the second most common approach is one based on scenario analysis,[154] although, as emphasised above, it is possible to apply approaches based on other methodologies.

This approach, unlike the scenario analysis used in the LDA method, employs far more scenarios with the aim of covering lower risk events as well. Individual experts therefore estimate first the distribution functions of the severity and frequency of the losses and then the parameters of the chosen distributions. Internal data can then be used, for example, to test whether the scenarios created in an area where there is sufficient internal data correspond to the scenario analysis estimates.

### 4.3. Capital allocation using the group AMA approach – potential impacts on the Czech financial sector

All institutions in the Czech Republic that are using or planning to use an AMA in the near future are part of large international financial institutions. The parent companies, as mentioned earlier, are predominantly developing the group-wide approach. Individual group members thus contribute all the required data to the model, and these data are used to calculate the capital charge at group level, including group diversification effects. This capital charge is then distributed across the individual institutions using allocation algorithms often based on readily available indicators such as total assets, gross profit or number of employees. If, however, the diversification

153 The POT (peaks over threshold) approach.

154 The SBA (scenario based approach).

effects implicitly included in the group calculation are not removed prior to allocation, it is necessary to verify whether the allocated capital is commensurate with the size of the risk undertaken by the specific subsidiary (here meaning a subsidiary bank operating in the Czech Republic, although the information given below is universally applicable). For the Czech banking sector, this problem is particularly important, because the vast majority of banks are subsidiaries of major European banks, some of which already use an AMA or are preparing intensively to do so.

The problem of allocation associated with diversification effects can be illustrated using the following example, which sets out to compare the individually calculated capital charge with the result derived from the group calculation[155] with subsequent application of the now common allocation mechanism with no adjustment for diversification effects.

For the purposes of the simulation, the frequently employed distribution functions were chosen – the Poisson distribution for the distribution of the number of events and the log-normal distribution for the distribution of the individual loss amounts. For the sake of simplicity, we assumed that the group consists of three identical institutions. Hence, the same distribution functions describing the operational risk level were chosen for both the individual and group calculation, with relevant adjustment of the parameters in the case of the determination of the number of losses. For the same reason, an allocation ratio of one-third of the group capital charge was set for the allocation of the group capital charge to each of the institutions, in line with simple allocation mechanisms.

The specific parameters used in the simulation were the following:

| | |
|---|---|
| Log-normal distribution (loss amount)[156] | parameter $\mu = 10$ |
| | parameter $\sigma = 2$[157] |
| Poisson distribution (number of events): | parameter $\lambda = 5$ (individual calculation)[158] |
| | parameter $\lambda = 15$ (group calculation). |

Using the chosen parameters, a Monte-Carlo simulation was performed separately for the group and individual calculation. In the simulation the following series of steps was followed in both cases:

1) the total loss amount for the period was simulated 100,000 times, and in each step
   a) the number of events (the random variable from the Poisson distribution with the relevant parameter) was generated,
   b) according to the value of the random variable from the previous step, the corresponding number of individual losses from the log-normal distribution was generated,
   c) the total loss in this step was determined,[159]

2) the quantile was calculated from the total losses generated in step 1 at a confidence level of 99.9%, which corresponds to the regulatory requirement for the operational risk capital charge,

3) for the simulation of the group calculation, the resulting quantile was multiplied by 1/3 as explained above, due to the subsequent use of the allocation mechanism.

The outcome of the above simulation is that an institution which is not a group member or which performs the calculation itself would have to maintain operational risk capital coverage of around 26 million currency units in the case of the individual calculation, while an institution incorporated into the group calculation with subsequent allocation would be able to maintain capital of just 16.5 million currency units thanks to group diversification effects.

155 The calculation performed at group level using data from the individual group members.

156 These parameter values are only illustrative, but similar values are also used in practice.

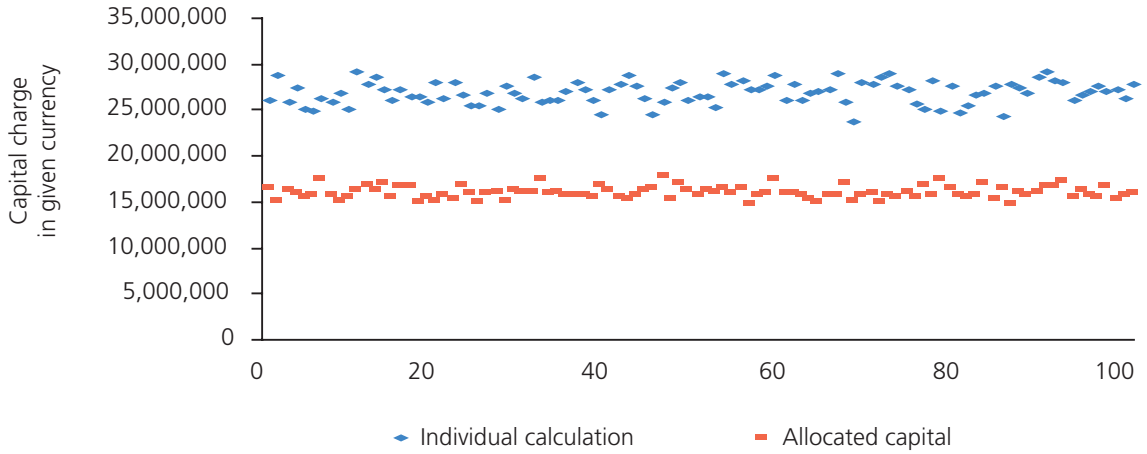
157 The mean of this random variable is equal to $\exp(\mu + \sigma^2/2)$ and the variance $\exp(2\mu + \sigma^2)\exp(\sigma^2-1)$.

158 The mean and variance of this random variable are equal to parameter $\lambda$.

159 In terms of symbols $s = \sum_{i=1}^{Y} x_i$ , where S is the total loss amount for the period, Y is the random number of events for the period and $X_i$ is the random amount of one loss.

In order to reduce the statistical error of adopting a conclusion based on just one simulation, the aforementioned simulation was repeated 100 times. The result is shown in the chart.

**Chart 2 – Simulated OR capital charge**




Source: CNB

The repetition of the simulation confirmed the validity of the above conclusion that the group-wide calculation with subsequent allocation leads to a significantly lower capital charge than the individual calculation. It is also worth mentioning that according to the results presented in the chart even the highest capital charge calculated using the allocation mechanism is 25% lower than the lowest capital charge calculated on an individual basis.

Since parent companies do not usually provide group members with any legally binding guarantees to provide additional capital where necessary to cover losses due to operational risk, this capital saving within the group as a whole is not sufficiently justifiable from the subsidiary's perspective. It is therefore necessary to perform tests of the adequacy of the capital allocated from the point of view of the individual group members, especially when allocation mechanisms are applied that do not eliminate group diversification effects.

Clearly this is just an illustrative example and the capital saving may be different in practice. However, the example demonstrates that if group diversification effects are not eliminated prior to applying the allocation mechanism, the capital charge can be significantly underestimated from an individual perspective for individual subsidiaries. One of the specific responses of the CNB supervisory authority to this fact has been to set a prudential benchmark (threshold) for the operational risk capital charge.[160]

### 4.4. Insurance as an eligible technique for reducing the operational risk capital charge

When using the AMA, unlike all the other available approaches for calculating operational risk capital charges, a bank is allowed to reduce its calculated capital charge if some of its operational risks are insured and transferred to insurers outside its financial group, provided that the insurance policies meet other specified conditions. In such case, the operational risk capital charge can be reduced by up to 20%. Besides insurance, other operational risk mitigating techniques can be applied, although their use for reducing capital charges is conditional on prior supervisory assessment and approval. The application of derivatives is most often mentioned in this context, but this option is little used in practice as yet.

160 Official Information of the Czech National Bank of 16 November 2007 regarding the prudential rules for banks, credit unions and investment firms – a benchmark for the operational risk capital charge.

In the Czech Republic, too, insurance mitigation is the only such technique being considered at present. Its impact is so far relatively insignificant and the savings being achieved are only a few per cent of the operational risk capital charge. Although the technique only involves the transfer of risk out of the relevant institution or group, and not out of the financial sector, this issue is not currently a priority with regard to the financial sector as a whole. However, it requires continued vigilance.[161]

## 5. CONCLUSIONS

The main results of the study include an initial assessment of the real impacts of the newly introduced mandatory operational risk capital charge on the total capitalisation (capital adequacy) of banks in the Czech Republic and a comparison with earlier estimates and predictions. Importantly, we have demonstrated that the operational risk capital charge is potentially underestimated where a group-wide operational risk measurement model is used and capital is subsequently allocated to banks in the Czech Republic. Other important findings include confirmation of the potential of operational risk to significantly affect financial institutions' risk profiles, as well as the limited scope for limiting the impacts of operational risk on the financial sector as a whole given the dominant status of insurance as an eligible technique for mitigating operational risk in the banking sector.

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161 See, for example, Joint Forum (2003).