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Overview of Operational Risk Management Methods

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***Abstract*—**Operational risk has become one of the most discussed topics in the financial industry in the recent years. The reasons for this attention can be attributed to higher investments in information systems and technology, the increasing wave of mergers and acquisitions and emergence of new financial instruments. In addition, the New Basel Capital Accord (known as Basel II) demands a capital requirement for operational risk and further motivates financial institutions to more precisely measure and manage this type of risk. The aim of this paper is to shed light on main characteristics of operational risk management and common applied methods: scenario analysis, key risk indicators, risk control self assessment and loss distribution approach.

***Keywords*—**Operational risk, economic capital, key risk indicators, loss distribution approach.

I. Introduction

UNTIL Basel II requirements in the mid 1990s, operational risk was largely a residual category for risks and uncertainties that were difficult to quantify, insure and manage in traditional ways. For this reasons one cannot find many studies focused primarily on operational risk until the late 1990s, although the term 'operations risk' already existed in 1991 as a generic concept of Committee of Sponsoring Organizations of the Treadway Commission.

Operational risk management methods differ from those of credit and market risk management. The reason is that operational risk management focuses mainly on low severity/high impact events rather than central projections or tendencies. Operational risk can build ideas from insurance mathematics in the methodological development [5] or [19]. Hence one of the first studies on operational risk management was done by Embrechts et al. [10] who did the modelling of extreme events for insurance and finance. Later, Embrechts conducted further research in the field of operational risk (e.g. [7], [8] or [9]) and his work has become classic in the operational risk literature. Subsequently, other researchers such as de Fontnouvelle et al. [12], Moscadelli [17], de Fontnouvelle et al. [11], Nešlehová [18] or Dutta and Perry [6] experimented with operational loss data over the past few years. For more details on operational risk management during the global financial crisis we refer to [23], [24] and [25].

Operational risk modelling helps the risk managers to better anticipate operational risk and hence it supports more efficient risk management. There are several techniques and methodological tools developed to fit frequency and severity models including the Extreme Value Thoery (EVT) [5], Bayesian inference [24], dynamic Bayesian networks [21] and expectation maximisation algorithms [3]. When modelling operational risk, other methods that change the number of researched data of operational risk events are used. The first one are the robust statistic methods used Chernobai and Ratchev [4] that exclude outliers from a data sample. On the other hand, a stress-testing method, what we analyzed in this paper, adds more data to a data sample and is widely used by financial institutions [1], [23] or [22]. More recently, Peters and Terauds [20], van Leyveld et al. [15], Chernobai et al.[4] or Jobst [14] summarise an up-to-date development of operational risk management from both views of academics and practitioners.

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II. Operational Risk Background

The most common definition of operational risk (OR) is given in Basel II as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk" [2]. However, other definitions exist as well. A very general definition says that OR is a consequence of doing business. OR thus bundles relatively broad area of risks which differs it from market and credit risk. The common idea is that operational risk encompasses those risks, not covered under credit and market risk that have a measurable financial impact. Table I categorizes OR by its main drivers.

There are some specifics of OR in comparison to market and credit risks that in general make OR more difficult to manage. "The main differences are the fact that operational risk is not taken on a voluntary basis but is a natural activity performed by a financial institution" [26] and a noticeable lack of hedging instruments. There are some widely known and severe magnitude of OR events that happened in recent years – the most publicly known examples of OR would be those caused by fraud, natural disaster or unauthorized trading – one very recent OR event from the Czech Republic is the theft of USD 31 million in the G4S Cash Services in 2007. The other example would be a $53 million loss to CSOB as a result of improper trading in 2000 or a failure of internet banking of Ceska Sporitelna in December 2007. The mostly known foreign OR events starts with a large loss in the amount of USD 7.5 billion caused to Société Générale by unauthorized derivatives trading by Jerome Kerviel in late 2007. Another category of events is connected with terrorist acts or natural disasters – like losses caused by 9/11 events or hurricane Katrina. Each of those events exceeds loss amount of USD 1 billion. It is clear that those events are the most severe but very infrequent ones. They represent high risk for a financial institution. There are other loss events that are more common but cause much smaller loss to a bank – like an input error caused by an employee or a failure of a supplier.

For OR modeling it is crucial to distinguish between regulatory and economic capital. Regulatory capital is the amount of capital necessary to provide adequate coverage of banks' exposures to financial risks as defined in the capital adequacy rules set by the Basel II. "A one-year minimum regulatory capital is calculated as 8% of risk-weighted assets" [4]. Empirical studies show that operational risk regulatory capital, in general, constitutes about 25% of overall capital adequacy requirements. On the other hand, economic capital "is a buffer against future, unexpected losses brought about by credit, market, and operational risks inherent in the business of lending money" [16] or alternatively economic capital might be defined as the amount necessary to be in the financial business.

Further we will focus on modeling both regulatory and economic capital for OR because this concept is to be used for the Advanced Measurement Approach as it should cover all unexpected losses – even the extreme events with the Value at Risk (VaR) higher than 99.9%. Regulatory capital covers expected losses and unexpected losses only to a certain confidence level and it does not consider the extreme events like economic capital does. The regulatory capital will be further defined as the VaR0.999 measure and the economic capital as the CVaR0.99 measure.

III. Basel II Operational Risk Measurement Techniques

Basel II sets three operational measurement methodologies for calculating operational risk capital charge "in a continuum of increasing sophistication and risk sensitivity" [2]. The first two approaches – Basic Indicator Approach (BIA) and Standardized Approach (SA) - are top-down approaches, because the capital charge is allocated according to a fixed proportion of gross income. The third approach – Advanced Measurement Approach (AMA) - is a bottom-up approach, because the capital charge is estimated based on actual internal OR loss data.

The motivation for banks to move from a less advanced to a more advanced technique is the increased risk sensitivity and in general lower expected capital requirement. Once a bank chooses to move to a more sophisticated approach there is no option to revert back. The most advanced Basel II approach for operational risk assessment is the AMA. "Under the AMA, the regulatory capital requirement will equal the risk measure generated by the bank's internal operational risk measurement system using the quantitative and qualitative criteria" [2] that are given in Basel II. The use of AMA is subject to a supervisory approval. Under the AMA the OR data are divided into the seven event type classes and eight business lines. So the particular AMA technique chosen by a bank should work with a matrix of seven event types and eight business lines.

Since the operational risk measurement techniques are still under development, Basel II does not set any standard technique for the AMA, thus the banks are allowed to develop their own models. Basel II encourages the banks to further develop increasingly risk sensitive OR allocation techniques, that will correspondent with the empirical loss data for the particular bank. The AMA thus provides significant flexibility to banks – on the other hand, regulators are given better control than the AMA techniques used by a particular financial institution.

IV. Common Operational Risk Management Measurements and Techniques

The other measurement methods not specifically mentioned in Basel II are also being used by financial institutions. There are four main techniques used to measure OR. The basic features of those techniques are listed in the Tab. 2.

The most theoretical measurement approach is the LDA. This method was already explained above and will be discussed in more details in the following chapter. Because of the fact, that the OR management is a relatively new concept, there are not enough historical OR events in internal loss database of a financial institution and thus statistical methods applied on a limited data sample may provide biased or inconsistent results. It is assumed that as the number of events in internal and external databases will grow, the LDA approach will become the prevalent one. Some other disadvantages of the LDA exist. The LDA is purely based on historical OR events that might not be the best predictor of the future and might reflect crucial changes in OR exposure of a financial institution with a several years gap. So even if the LDA is the most advanced, objective and theoretical method it is still useful to combine it with other approaches in order to control OR exposure of a financial institution.

The second method is the Scenario Analysis. This method can be classified as a stress testing method. A financial institution can obtain valuable results from analyzing scenarios that cover infrequent but severe risks that can have severe impact on bank operations. The other reason is to measure the exposition to plausible risks that has not happened so far and thus are not registered in the internal OR loss database. The other two methods – Key Risk Indicators (KRI) and Risk Control Self Assessment (RSCA) are discussed in more details in Rippel [22].

Once a financial institution determines the specifics of its OR exposure, its managers can take several actions to manage OR. There are five ways to manage OR – they are described in Tab. 3. The aim of a financial institution is to minimize the amount of residual OR. The procedure is to identify the level of inherent risk, implement risk mitigation techniques and then evaluate the level of residual risk. If some risk is not controllable by internal means, then the risk should be transferred either to insurance company, to a 3rd party using outsourcing or such an activity should be limited.

V. Conclusion

The paper discusses main characteristics of operational risk management and its implications for economic capital management. The most common definition of operation risk is given in Basel II as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Operational risk modelling helps the risk managers to better anticipate operational risk and hence it supports more efficient risk management. There are several techniques and methodological tools developed to fit frequency such as EVT, Bayesian inference, dynamic Bayesian networks or expectation maximisation algorithms.

Basel II sets three operational measurement methodologies for calculating operational risk capital charge in a continuum of increasing sophistication and risk sensitivity. The first two approaches – Basic Indicator Approach and Standardized Approach - are top-down approaches, because the capital

charge is allocated according to a fixed proportion of gross income. The third approach – Advanced Measurement Approach - is a bottom-up approach, because the capital charge is estimated based on actual internal operational risk loss data. The other measurement methods not specifically mentioned in Basel II are also being used by financial institutions: scenario analysis, key risk indicators, risk control self assessment and loss distribution approach). On a related note, banks managers can take several actions to manage operational risk such as precautionary arrangements, business continuity management, transfer risk to insurance companies, outsourcing and taking the risk.

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