Stress testing framework for Operational Risk loss estimation

(Review of practices employed in CCAR/DFAST)

Introduction

Financial services industry has witnessed huge losses/bankruptcy filings by many organizations due to the events related to operational risk. In the recent period, losses due to this risk including cyber threat, rogue trading etc. assumed more prominence. Accordingly, regulators across the world have been particular about integrating operational risk loss estimation to the enterprise level risk management framework. Further, there is an increased scrutiny around the practices employed for measurement of operational risk and regulators have advocated for a robust data driven quantitative framework to estimate the losses and thus the capital allocation.

This paper details the measurement of operational risk with focus on stress testing along with the challenges faced in the process of development of the framework. It initially outlines various event types that are captured as part of operational risk and then gives an overview on the different modeling approaches for estimating losses due to each of the event types. It also explains the need for usage of external loss data along with the internal loss data for developing the loss forecasting models as part of CCAR/DFAST stress testing. Finally, it concludes with the limitations and future prospects of the framework.

The major challenge in capturing operational risk for a bank is modeling the nature of events that contribute to operational risk losses. Further, operational risk measurement involves estimating the legal losses/reserves for the litigations of any manner. In this regard, it is observed that the legal losses tend to exhibit a slightly different pattern during the period of stressed economic periods. Accordingly, the model developed for forecasting the legal expenses including potential future litigations need to incorporate this behavior in the model.

Further, the regulators have actively advocated the need for developing regression based models to establish the relation between losses and the macroeconomic variables. Many of the BHCs have found it difficult to establish the relation, even though a few of the BHCs were able to implement them, due to the lack of internal loss data for various event types. Further, the development becomes more complex due to multiple periods of lag observed in occurrence of the macroeconomic event and operational risk loss recognition. However, BHCs have been making best possible efforts to make use of the external data sources like ORX, ABA along with internal loss data to develop the regression models.

The organizations have developed models for event types where the relationship could be fairly established and a structured approach has been developed to integrate these loss estimation models in appropriate manner for regulatory stress testing exercises i.e. CCAR,DFAST. It is to be noted here that there are many difficulties in integrating external loss data to the existing internal loss data due to the general weaknesses observed for any of the external data sources and this was being attended on priority by the BHCs.

Prior to understanding the different approaches for loss estimation, there is a need for understanding the mechanism of data collection and the data sources used in the models including internal and external as input data occupies a prominent role in loss estimation. Many of the BHCs has loss data captured post the financial crisis and thus do not contain a significant downturn of economic events in the data. This has resulted in the requirement for external data which could significantly add value to the existing data. More information about the data collection and processing is discussing in the following section.

Each of the loss events is broadly classified in to seven major loss event types as published under Basel II. The paper does not focus on definitions of these event types as these can be sourced from Basel document. The nature of each of the event types is a list of the event types is presented in the below figure.

As explained earlier, operational risk loss events are typically low probability, high impact events in majority of the occasions. Such a complex behavior is difficult for modeling and hence developing accurate loss forecasting models in operational risk management has been an area of concern. In terms of statistical modeling perspective, it is observed that historical operational loss data is fat tailed, non-symmetric distributed and hence considering parametric approach may not be appropriate. There have been initial recommendations for estimating losses based on Extreme value theory and the relevant fat tailed distributions. However, major progress has not been achieved in that area due to the complexity involved in modeling the losses. The complexity of this exercise can be better explained by rationale motivating the recent directive from Basel to employ standardized approach only for capital estimation due to operational risk and withdrawal of Loss distribution approach (LDA).

Typically any of the approaches for estimating operational risk losses can be broadly classified in to three categories

1. Regression based models
2. Historical simulation based models
3. Expert Judgement based models

Loss distribution approach was earlier used by many of the BHCs as part of AMA approach for operational risk loss estimation. However, with Basel authorities withdrawing the AMA approach and proposing standardized approach for Operational risk capital estimates, LDA approach is also withdrawn from the desired approaches for loss estimation. Many of the BHCs are incorporating either one of the above mentioned approaches or a combination of them for loss across different event types.

Loss estimation procedure

The internal loss data that is being used in the framework is sourced from regulatory submissions i.e. FR Y 14Q loss events data files submitted on quarterly basis. The classification of loss events by different event types is performed and then aggregated along with the external events at event type level across different business lines. It is expected that the quality of the data that is being obtained from above procedure goes through various monitoring mechanisms as part of data governance process for BHCs. Loss estimation in each of the approaches mentioned above is discussed below.

Regression based models

The magnitude of stress on macroeconomic variables in adverse and severely adverse supervisory scenarios is provided by FED. Hence, developing the regression models to establish the relationship between loss event types and macro-economic variables can ease the process of estimation of losses due to operational risk in these stress scenarios. Accordingly, the regression models are being developed by BHCs to estimate either loss frequency/severity or both of them. In this regard, the hypotheses are made on the probable and possible relationships between the variables and event types for each of them. The loss frequency is modeled using either Poisson regression or Negative binomial regression technique based on dispersion. Even though the actual loss data can provide a different picture on the relationship, the hypotheses for the probable relationship between various event types and macroeconomic variables need to be finalized. Accordingly, the probable hypotheses are mentioned in the below table.

	EF	IF	EPWS	CPBP	DPA	BDSF	EDPM
Definition	Losses due to acts of fraud by a third party	Losses due to acts of fraud by internal party	Losses due to internal employees malpractices	Losses due to failure of meeting client requirement	Losses due to damage of physical assets	Losses due to business/system (For e.g. IT) failure	Losses due to failure in delivery/ process of transactions related to vendors & counterparty
Relation	Negative correlation with macro variables like GDP	Negative correlation with macro variables like GDP	Negative correlation with Unemployment rate	Negative correlation b/w macroeconomic variables and the loss event type	Remote possibility of correlation	Remote possibility of correlation	Negative correlation b/w macroeconomic variables and the loss event type

It has been observed in many instances that there were deviations from relationships proposed in hypotheses i.e. relationships were either non-significant or very weak thus resulting in accepting alternate hypotheses. In this regard, the variable selection from large number of macro-economic variables along with the lag and interaction variables developed from them becomes a challenge and a lot of emphasis remains on variable selection process for developing robust models. The models developed based on these variables can be used to estimate losses in the various supervisory scenarios as the stresses for the relevant macroeconomic variables are already defined by regulator. It is to be noted here that the models provide loss frequencies which are multiplied by average loss per event to estimate losses in each of the scenarios. The assumption made in such models is that average loss per event may not change significantly during the stress periods. A statistical test need to be made to accept this hypothesis provided sufficient data is available. Thus the losses can be estimated with this approach. However, a model can also be developed for severity and accordingly the above mentioned assumption can be avoided.

Historical Simulation based models

As the name suggests this approach is similar to the traditional non parametric approach based VaR models developed in market risk for loss/capital estimation. The historical losses from internal and external data sources for each of the event types are utilized to estimate losses at different percentiles. The percentiles are calibrated appropriately to represent adverse and severely adverse scenarios as part of regulatory stress testing exercise.

It can be noted here that the historical simulation has inherent advantages/disadvantages that are associated with such simulation techniques as observed in the area of market risk.

Expert judgement based Models

The major obstacle with developing a quantitative model in operational risk domain is lack of sufficient data and various BHCs have employed the expert judgement for arriving at the loss estimates in their initial stages. Typically the losses are estimated at baseline scenario and then those are scaled up by factors developed using qualitative study for adverse and severely adverse scenarios. Estimating the scaling factor is highly subjective and can be a topic for discussion/anomaly in these types of models. Further, the baseline losses are also based on basic statistical measures of the losses i.e. mean, median etc. and will also be subject to such issues. This model is primarily applied in the initial stages of model development life cycle of a BHC and will form initial step for evolution of robust quantitative models for operational risk loss estimation.

Legal losses and reserves

Legal losses form one of the parts of operational risk losses and it occupies a major role in operational risk management framework. Data regarding legal losses is highly confidential and is typically not shared with larger group of resources even within the organization. Further, losses due to legal events are typically unique and vary significantly based on the type of legal event. Accordingly, modeling the legal losses becomes more complex. Finally, there is generally a huge lag in time period between initiation of legal action and the verdict declaration and reserves need to be maintained on a periodic basis for the litigations/law suits. Accordingly, modeling legal losses would involve developing model for both the legal losses as well as legal reserves.

It has been a common practice that the legal losses are modeled based on the historical loss data and then applying scaling factors for losses in stressed scenarios as explained in expert judgement based models. However, legal reserves estimation requires a different approach as cumulative behavior need to be modeled in comparison with point in time estimates as modeled for other loss events. Further, the comprehensive analysis of historical and pending litigations and the probable impact of these litigations on the balance sheets need to be understood in a better manner. Legal loss estimation framework would require estimating potential future litigations as part of CCAR/DFAST and there is no unique technique/template followed by BHCs with respect to loss estimation for potential future litigations.

Potential Future litigations

Across the industry, there is no standard benchmark practice for potential future litigations and this adds complexity to modeling them. One of the possible approaches can be considering historical data and assuming that historical data is a good representation of future and going ahead with developing model in those lines. Another approach can be considering the process followed in developing rating transition matrix. This approach involves estimating the probability of issues resolved/initiated during different time periods and then estimating losses during the period of the next nine quarters. These approaches are not the exhaustive list of practices followed and there can be many more approaches which can be used for modeling potential litigations.

Idiosyncratic Scenario analysis

BHCs in many of the instances have developed idiosyncratic scenarios in addition to the regulatory scenarios to understand relevant stresses for the organization. Typically organizations focus on the event types which contribute the maximum operational losses and then accordingly develop idiosyncratic scenarios for stress on those event types to understand the maximum impact/losses in stressed conditions. It is primarily considered as a sense check to the regulatory scenarios rather than being considered as part of the stress testing. A few of the idiosyncratic scenarios can be failure of IT infrastructure, fraudulent transactions across the entire spectrum of bank accounts etc.

Future prospects

One of the studies made by EBA on the performance of the banks indicates that operational risk and credit risk at large European banks increase simultaneously, under stressed conditions. This study may be highly relevant to the banks across the globe. However, the efforts to integrate the various components of risks for a bank considering the strong correlations within them are in initial stages and may need to be integrated to form industry best practices. There are many such instances of risks that are not adequately being captured by the risk management framework that can be identified either during the validation or review from auditors/regulators. Thus validation of the models occupies significant role for building a robust risk management framework.

Author

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