

## DIRECTED RISK RESEARCH PROPOSAL

<b>Risk Theme</b>	Operational risk (analysis)
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**Client Info:** (only applicable if proposal is in response to a client problem statement)

<b>PS Title</b>	Quantifying model risk of financial risk models				
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<b>University</b>	NWU	<b>Classification</b>	
<b>Problem Nr.</b>	PS16009	<b>Type</b>	Technology-Pull
<b>Proposal Nr.</b>	RP17001	<b>Date</b>	07 November 2016

**PROJECT TITLE:** Quantifying model risk of credit risk models

### PROJECT GOAL:

Propose a practical methodology to measure the estimation error of risk quantification models used in the modelling of credit risk.

### PROJECT SCOPE

In order to quantify model risk from credit risk models, two techniques may be followed: *Parametric Approach* and *Non-parametric (Bootstrapping) Approach*. Parameters can be obtained using logistic regression as a modelling technique. When estimating the parameters using logistic regression the model risk that may be created is the error that is made when the weights are estimated. Confidence intervals can be used in quantifying this model risk (Malan, 2017).

According to (Malan, 2017), in credit risk, calculating the uncertainty related to the estimator such as the mean or median used in LGD requires the use of non-parametric methods that do not assume the estimator's distribution. A more general technique which is mostly used is bootstrapping, which is a random sampling that generates  $n$  size samples that obtain the estimator's distribution function from the samples that were generated (Malan, 2017).

## **HIGH LEVEL DESCRIPTION OF PROBLEM**

Banks rely heavily on financial risk models to make business decisions and manage risk. These models include application scorecards, among others, deciding on new or amended credit facilities, behavioural scorecards for ongoing monitoring of customer credit worthiness, capital-demand models to comply with minimum regulatory capital requirements and estimate economic capital requirements, expected loss models for credit impairments and operational loss provisions, and stress testing models to test risk appetite, budgets and capital planning. As a consequence, banks are exposed to model risk when results obtained from models deviate from the "true" result.

In terms of Pillar II of the Basel Framework, banks are required to demonstrate that all material sources of risk are accounted for in its risk management practices as well as capital demand estimates. To this end the South African Reserve Bank (SARB) recently engaged various South African banks about their model risk management practices including quantification of model risk exposures. Various other host regulators are also increasingly scrutinising in respect of model risk management. It is noted from the literature that, apart from the USA Fed, there is currently limited guidance from regulators on model risk management and quantification. In addition, the lack of an industry standardised definition or guidance around quantification of model risk creates uncertainty around the expectations of regulators and comparability of model risk disclosures between banks.

The Operational Risk Data eXchange (ORX) recently conducted a survey (ORX, 2016) on the topic of model risk management and quantification. The key survey results were:

- a) Most banks include model risk in their risk taxonomy as part of operational risk.
- b) Ownership of model risk within banks is not as clear as for risk types such as credit, market and operational risk.

- c) Quantification of model risk is not common and when it is performed, it is mostly based on expert judgment.
- d) Participants of the survey indicated that they expect model risk to become a greater priority for their regulators.

Therefore, in light of the increased focus from regulators on model risk management and the quantification thereof, a method for quantifying model risk will be beneficial to the banking industry.

A number of publications around model risk are available and also confirm how varied model risk definitions are. Bertram *et al.* (2015) define model risk as “every risk induced by the choice, specification and estimation of a statistical model”. Glasserman and Xu (2013) refer to model risk as errors in modelling assumptions that impact risk measurement. Morini (2011) defines model risk as the “possibility that a financial institution suffers losses due to mistakes in the development and application of valuation models”. Alexander and Sarabia (2012) explain that the term model risk is “commonly applied to encompass various sources of uncertainty in statistical models, including model choice and parameter uncertainty”. Bignozzi and Tsanakas (2015) discuss model uncertainty and parameter uncertainty, and define the former as “uncertainty arising from not knowing the model” and the latter as “arising from uncertainty about the true parameters, assuming that the model has been correctly chosen”. The USA’s Board of Governors of the Federal Reserve System and Office of the Comptroller of Currencies (the Fed and OCC) (2011) states that model risk includes fundamental errors that may produce inaccurate outputs when viewed against the design objective and intended business uses, and the incorrect or inappropriate use of a model.

**PROJECT OBJECTIVES**

- Identify appropriate/relevant techniques (taking into account its practical application) for quantifying model risk in credit risk models.
- Compare all relevant techniques with one another.

**RESEARCH OUTPUTS / DELIVERABLES**

PUBLICATIONS:	Name(s) / Title(s)
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<b>STUDENTS:</b>	<b>Name(s) of Student(s)</b>
1 MSc student	Granville Malan
<b>OTHER:</b>	
Technical report with recommendations on methodologies for quantifying model risk of various financial risk categories' risk models.	
Possible publication in the in the academic financial literature	

### **APPROACH TO BE FOLLOWED**

In order to investigate methodologies for quantifying model risk of various financial risk categories' risk models, we propose the following steps:

- 1) Study and review the available literature on the topic.
- 2) Presentation and decision on various methodologies for quantifying model risk.
- 3) Presentation and decision on the best methodology for quantifying model risk for each financial risk category.
- 4) Technical documentation and summary.

### **STRATEGIC VALUE TO DIRECTED RISK RESEARCH**

This research will contribute conceptually to model risk analysis techniques applied in the banking industry and provide guidance on the quantification of model risk in the industry.