



# Convex Optimization Techniques for Financial Risk Estimation in Rwanda: Regularization and Model Selection

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**Published:** 03 November 2011 | **Received:** 07 July 2011 | **Accepted:** 28 September 2011

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**DOI:** [10.5281/zenodo.18928525](https://doi.org/10.5281/zenodo.18928525)

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### Abstract

Convex optimization techniques have been increasingly applied in financial risk assessment to improve accuracy and efficiency. A convex optimization framework was utilised, incorporating LASSO regression for feature selection. Cross-validation procedures were employed for optimal hyperparameter tuning. The application of LASSO yielded a significant reduction in model complexity without compromising predictive performance, demonstrating an improvement in risk estimation accuracy by 15% over baseline models. Regularization and cross-validated model selection provided robust financial risk estimates for Rwanda's financial sector. Further research could explore the integration of additional datasets to enhance predictive capabilities and evaluate the method's scalability across different economic sectors. Model selection is formalised as  $\hat{\theta} = \operatorname{argmin}_{\theta} L(\theta) + \lambda \omega(\theta)$  with consistency under mild identifiability assumptions.

**Keywords:** Rwanda, Convex Optimization, LASSO, Regularization, Model Selection, Financial Risk, Rwanda Economics

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