

DIRECTED RISK RESEARCH PROPOSAL

Risk Theme	Investment Risk
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Client Info: *(only applicable if proposal is in response to a client problem statement)*

Problem Title	Efficient Approaches for Pricing Swaptions on Amortizing Swaps		
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University	UCT	Classification	
Problem Nr.	PS17001	Type	Technology-Pull
Proposal Nr.	RP17002	Date	28 March 2017

PROJECT TITLE: Pricing Swaptions on Amortizing Swaps

PROJECT GOAL:

To find efficient, preferably non-parametric, approaches to pricing swaptions on amortizing swaps.

PROJECT SCOPE

Pricing swaptions under various models is well understood. In many models these instruments may be priced using analytical expressions. The goal of this project is to investigate the use of analytical or semi-analytical approaches to price swaptions on amortizing swaps.

PROJECT OBJECTIVES

The project aims to investigate one- or two-factor interest rate models that are amenable to producing efficient analytical or semi-analytical approximations to the prices of swaptions on amortizing swaps. The aim is to rigorously derive the necessary formula with special attention paid to the underlying assumptions. Finally, the validity and efficiency of these formulae will be tested against simulation approaches.

RESEARCH OUTPUTS / DELIVERABLES

PUBLICATIONS:	Name(s) / Title(s)
Dissertation	Pricing Swaptions on Amortizing Swaps
STUDENTS:	Name(s) of Student(s)
PhD (Quantitative Finance)	Ralph Rudd
MPhil (Mathematical Finance)	Ndinae N. Masutha
OTHER:	

APPROACH TO BE FOLLOWED

- 1) Test the exact pricing solution proposed for one factor affine interest rate models by Jamshidian in 1989.
- 2) Derive analytical or semi-analytical formulae, in a similar fashion, for one- or two-factor interest rate models, for the prices of swaptions on amortizing swaps.
- 3) Test the solutions against a Monte Carlo based pricing technique.

STRATEGIC VALUE TO DIRECTED RISK RESEARCH

In the asset-liability management context swaptions are regularly used to mitigate the risk associated with long-dated interest rate exposure. There is, however, a need to have non-constant pay-off profiles in such instruments. With an efficient pricing formula for such an instrument, risk managers can apply approaches such as sensitivity analysis or scenario simulation, which would be intractable if these prices could only be generated using computationally expensive approaches.

REFERENCES

Brigo, Damiano, and Fabio Mercurio. *Interest rate models-theory and practice: with smile, inflation and credit*. Springer Science & Business Media, 2007.

Henrard, Marc. "Efficient swaptions price in Hull-White one factor model." *arXiv preprint arXiv:0901.1776* (2009).

Peterson, Sandra, Richard C. Stapleton, and Marti G. Subrahmanyam. "A multifactor spot rate model for the pricing of interest rate derivatives." *Journal of Financial and Quantitative Analysis* 38.04 (2003): 847-880.