DIRECTED RISK RESEARCH PROPOSAL

Risk Theme	Market Risk

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

Problem Title	Efficient, practical methods for pricing and risk-managing derivatives in dynamic markets.				
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University	UP	**Classification**	Restricted
Problem Nr.	PS15014	**Type**	Technology-Pull
Proposal Nr.	RP15024	**Date**	3 August 2015

PROJECT TITLE: Comparison of parametric & non-parametric methods for creating volatility surfaces in illiquid markets

PROJECT GOAL:

Evaluate methodologies to create realistic volatility surfaces in illiquid markets.

PROJECT SCOPE

Estimating volatility surfaces accurately is critically important for any derivatives market participant, whether it be for direct pricing and delta-hedging or more generally for efficient portfolio hedging and risk management. While international literature in the broader area of implied volatility modelling is vast, the majority of these studies are based on index implied volatility surfaces and, furthermore, are not applicable to illiquid markets where estimating such surfaces is not a trivial task. In this research, we consider the problem of estimating volatility surfaces in illiquid single stock option (SSO) markets. Despite their illiquidity, such an SSO market still generally trades on non- constant volatility surfaces, even if these are neither observable nor readily available. We propose four alternative methods for creating dynamic volatility surfaces in such circumstances.

PROJECT OBJECTIVES

Firstly, we consider Dupire's break-even volatility, which defines the volatility surface that zeroes the average P/L function of a delta-hedged option over a given historical period. Secondly, we consider Stutzer's (1996) canonical valuation, which calculates the volatility surface from the risk-neutralised historical return distribution of the underlying asset; found by minimising the relative entropy between the two distributions. We also introduce a new variant of this method which accounts for the underlying historical moments and allows one to condition the surface on the current moment estimates. These first two methods are fully non-parametric and only require return data. Thirdly, we consider Bakshi, Kapadia & Madan's (2003) method of initially modelling the unknown implied SSO distribution moments respectively as a function of an existing implied index distribution and subsequently backing out SSO volatility surfaces. Finally, we consider a direct calibration process of the Gatheral's (2004) stochastic volatility inspired deterministic model, whereby the fitting procedure incorporates illiquidity issues via a time- and size-weightings vector, sector averaging and also incorporation of the index-single stock relationship.

RESEARCH OUTPUTS / DELIVERABLES

PUBLICATIONS:	**Name(s) / Title(s)**
Articles	1
STUDENTS:	**Name(s) of Student(s)**
Ph.D.	
M.Sc.	
OTHER:	

APPROACH TO BE FOLLOWED

1) Study relevant literature
2) Implement different methodologies
3) Examine practical use of different methods and compare findings accordingly.

STRATEGIC VALUE TO DIRECTED RISK RESEARCH

This research will contribute to practical volatility surface construction especially for illiquid option markets – the results will have practical and academic significance.