FINM331/STAT339 Financial Data Analysis – Hanson – Winter 2010

Lecture 7 Homework 7 Individual Project : Implied Volatility and Kernel Smoothing:

(Professional Project Report for Weeks 7 – 8 Due by Lecture 9 in Chalk FINM331 Assignments; worth 100 points)

You must show your work, code and/or worksheet for full credit.

- ***General Problem Objectives:***

  The models in quantitative finance are known to be deficient in many ways as far as representing real market behavior. This does not mean that the models are entirely wrong, though some quantitative analysts would say that. However, sometimes some important parameter, such as volatility, of financial derivatives can be readjusted from their underlying asset historical values, i.e., parameters estimated from the data of the underlying assets. This is the case of the Black-Scholes implied volatility that is the volatility that when used in the Black-Scholes model matches the derivative data for a range of derivative expiration times and payoff values. The implied volatility is of great importance because it allows traders need current implied volatilities more accurate prediction of derivative prices and update contracts when the market changes significantly.

- ***Methodologies:***

  Implement the ***7.2.8 Implied Volatility (pseudo-)Algorithm with Kernel Regression and Numerical Inversion*** to find the implied volatility parameterized implied volatility curves versus moneyness and the implied volatility surfaces versus moneyness and exercise times for **Black-Scholes (BS) European call option pricing formula** and the **zero-one compound Poisson jump-diffusion (CJD) European call option pricing formula** with the binary Poisson mixture of Black-Scholes formulas. (A variation on Merton's (1976) jump-diffusion generalization of the BS&M option pricing model.) *Remark: The usual substitutions of other methods is still operative, but you are on your own.*

- ***Some Hints on Methods:***

  1. You need to scale variables for better numerical performance.
  2. You need to time your methods to measure the efficiencies of the methods, since on the job you may not have much time to wait for an answer and as they say *time is money*.
  3. You need to make sure you are using double precision, the MATLAB default, i.e., the MATLAB machine epsilon command `eps` should return `2.2204e-16` (The machine epsilon is the smallest positive number that when added to 1 is still greater that one, e.g., with a 0.001% level of confidence `1+0.99999*eps = 1`.
  4. You need to professionally label your plots and other output, still.

- ***Project Report:***

  Your ***professional, individual report*** needs the following parts:

  1. ***Cover Page***: Put a project title, your name, your affiliation, date and other identifying information on this individual computer project. What you submit must be your own work (this in NOT a group project) and points will be deducted for similar work.
  2. ***Executive Summary***: This is about a page summarizing the project and your results for a busy boss. This should be in the form of a outline or itemized list for easy and fast reading. Also, a summary or/and critical result graph(s) would be important. Hopefully might encourage the boss to read the whole report.
  3. ***Project Description or Introduction***: Describe the project in your own words as an introduction to your report, in sufficient depth so that a reader such as yourself would understand it.
  4. ***Methods***: Describe the mathematics and the algoritms behind these methods used to solve the problem, giving both advantages and disadvantages in a fair manner.
  5. ***Results***: Describe the nature of the results and illustrate them with appropriate tables or plots. You can use MATLAB for plotting your results. Clearly label tables and plot figures in a professional manner. Detail and discuss what your significant contributions to this project are.
  6. ***Discuss***: Discuss the results, including how they can be used elsewhere for different industrial applications. Explain how and why methods differ or do not differ.
  7. ***Acknowledgements***: Acknowledge what resources you used in this project, including what versions of MATLAB that you used, the operating system, the computer or hardware platform, persons consulted (important: grade is discounted for similar reports and unacknowledged use of other sources), and any other resources (references are listed in the next section) used. Give URL links to any software that are not in the standard MSFM software. Acknowledge anyone that helped you.
  8. ***Conclusions***: List what you have learned from this project and explain why it is significant.
  9. ***References***: Cite all books, scientific papers, web-sites and other library or web resources that you used. Give author, title, journal name or book publisher or URL where appropriate, and date of publication or web access.
  10. ***Appendices***: Include MATLAB documented source code and output.