Estimating and Comparing Implied Volatility and Historical Volatility of Google Stock

Sponsor: OneMarketData

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Outline

Overview

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About Our Sponsor

The Modeling and Analytics Department, OneMarketData

Problem Statement

Equity Market Group in OneMarketData is working on a project focused on comparing implied volatility and historical volatility. Now they have a limited capability to estimate the stock volatility through different methods.

Milestones

1. Work Statement Due Date:Oct1,2012
2. Midterm Presentation due Date:Oct 12,2012
3. Progress Report due date: Oct 26,2012
4. Final Presentation due date:Nov 6,2012
5. Final Report due date: Nov 30,2012

Deliverables

1. Algorithms for estimating the implied volatility and implied volatility surface
2. Algorithms for calculating historical volatility
3. Numerical results demonstrating the difference of above two methodology
4. Technical report and presentation summarizing the result

Approach

1. Obtain the data of call options on Google stock. Estimate the implied volatility from Black Scholes formula and use Matlab generate the implied volatility surface
2. Apply techniques of time series analysis to historical data to estimate the historical volatility. We will be using three time series models:
   - 2.1 Equally Weighted
   - 2.2 EWMA
   - 2.3 GARCH(1,1)
3. Analyze the difference of the results in statistics and parameterize the implied volatility surface using a model.

Estimating Implied Volatility

Black Scholes (1973) Model: options are presented in terms f the following variables:

1. the current price of the underlying asset
2. the option's strike price
3. the option's time to expiration
4. risk free interest rate
5. the volatility of the underlying asset

Estimating Historical Volatility

We estimated historical volatility using time series analysis on stock prices. We will use three methods and compare the results:

1. Equally Weighted
2. EWMA
3. GARCH(1,1)

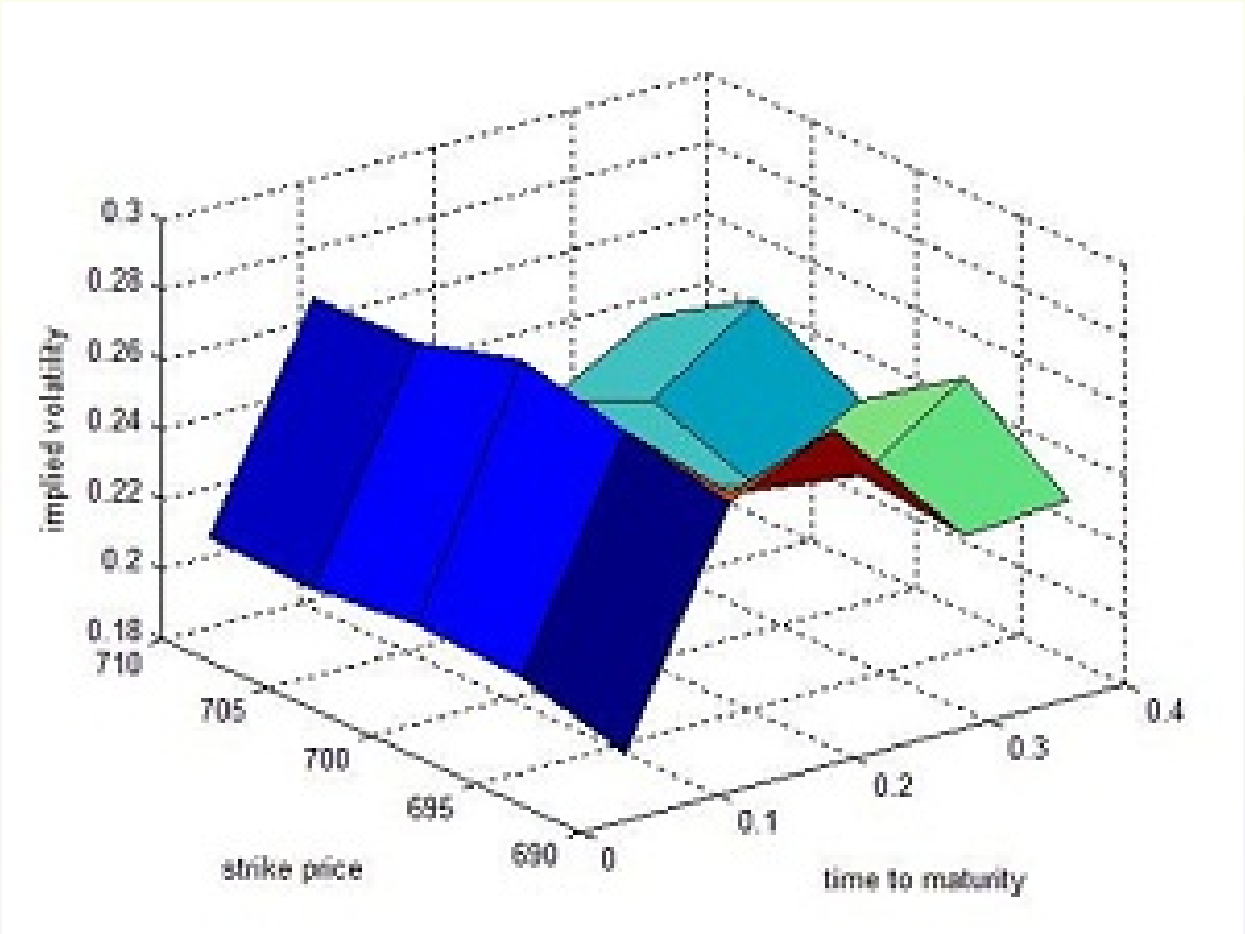
Comparing the two results

We will compare the implied volatility surface for specific day against the volatility given by the suitble time series model for that day.

1. Plot
2. Analysis

Current Research

Implied Volatility Surface:



Implied Volatility Surface

Progress

Have finished:

1. Collected the Google's daily stock price data within recent two years
2. Developed the code for generate implied volatility and generated the volatility surface

To do list:

1. Revise the Matlab code
2. Use Excel to apply three time series model to estimate historical volatility
3. Compare the results and parametise the implied volitility surface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