EVNINE & ASSOCIATES

Project Proposals 2009

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- Order Book Projects (1-3)
- Options Projects (4-5)
- Prediction and Optimization Projects (6-8)

Order Book

- Market participants can post either limit orders or market orders.
- A limit order is an order to buy or sell a certain amount of a security at a given price.
- The collection of outstanding limit orders an be summarized by the amounts posted at each price level. This is called the limit order book.

- When a market order arrives it is matched with the best available price in the limit order book and a trade occurs.

- A limit order sits in the book until either executed against a market order or canceled.

The first challenge is to map the state of the order book onto a set of relevant variables, for example

a) the mid-price, defined as the average of the bid and the ask,

b) the number of buy orders at a distance from the ask,

c) the number of sell orders at a distance from the bid.

The second challenge is to describe the dynamics of the book as it is updated by the inflow of new market orders, limit orders and cancellations.

We will provide order book data.

Project 1: Stochastic Model of Order Book

Students can try to reproduce the stochastic model proposed by Cont et al.

This model assumes that order arrival rates follow a Poisson process that depends on the distance to the bid/ask , with most orders being placed close to the current price.

Students can also see if they can reproduce some of the empirical observations in Bouchaud 2002 and Farmer 2004.

Project 2: Generalized Model of Order Book

Generalize the model in Cont et al to include a random arrival rate.

→ The arrival process will not only depend on the State (or past states) of the order book, but also on some external information.

Part of the challenge is to come up with an appropriate stochastic process.

Project 3 : Probability Distribution of Time to Execution

Follow Lo, MacKinlay, Zhang (LMZ)

The first challenge is to tie the arrival of an order to execution of that same order.

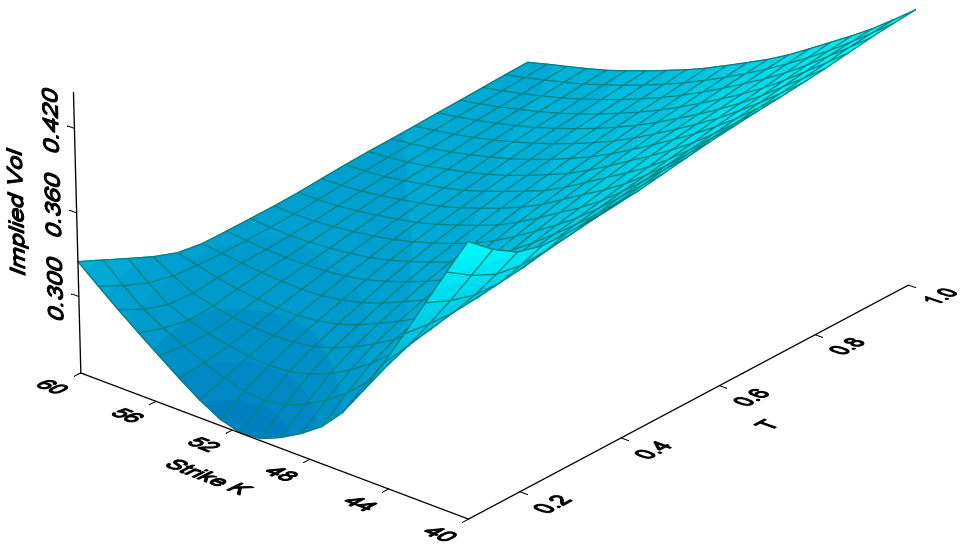
Perhaps deduce this from the order book data itself. We could also use EvA's limit order history assuming clocks are synchronized.

The second challenge to find the most appropriate set of explanatory variables for the model.

Project 4: Volatility Correlation Groups

Strike-independent implied volatility changes (q-alpha model)

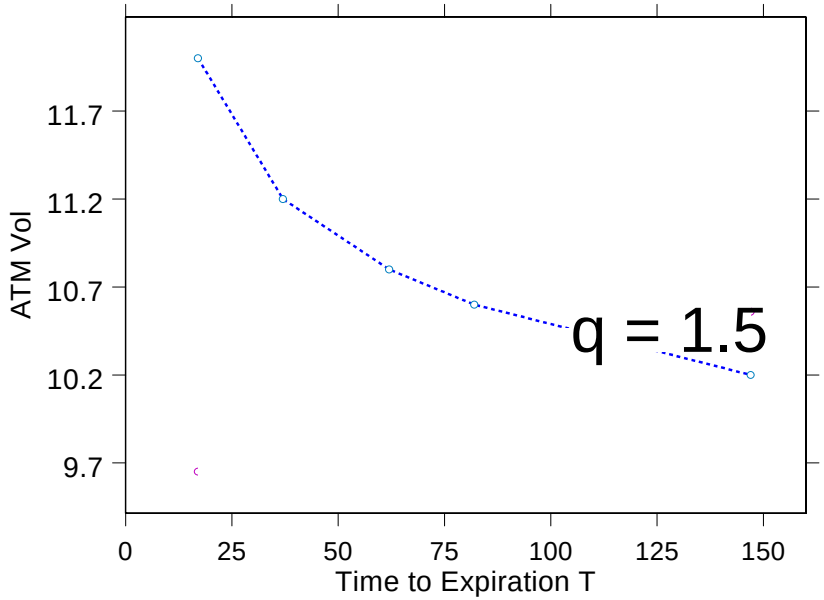
Black-Scholes volatility surface ….



In BS model need a sigma for each strike

In alpha-q model, need just 1 sigma for all strikes -> parsimony

…reduced to a line (term structure)



Project 4: Volatility Correlation groups

Strike-independent implied volatility changes (q-alpha model)

Challenge 1:

Perform PCA analysis, project data in reduced space, find clusters or peer groups

Repeat in stock return space

Are the correlations in return space equivalent or vastly different to those in volatility space?

Challenge 2:

Are residual volatility returns predictable ?

Project 5 : Model of Volume and Open Interest

How do volume and open interest for a particular strike evolve as a function of

current stock price

time to expiration

current volatility

and any other explanatory variables that one can think of ?

Is there any pattern that one can detect here, e.g. as a function of moneyness? What are the statistical signatures of these quantities? Can this be modeled?

Project 6 : Short and long-term prediction combination

Given two–term predictions with different certainty, trading costs, how to construct optimal portfolio.

Adiabatic elimination of slower moving variable?

Or follow the approach as in Garleanu and Pedersen (2009) : Different alpha decay rates.

We could provide expected returns from a near term prediction model (stat arb) and a longer term prediction model (EMN).

Project 7 : ICA for Prediction

Perform, over time, an independent component analysis (ICA) of the US stock universe that we can provide.

The first task would be to examine them and see if they have any economic meaning.

The second task would be to see if changes in ICA' are predictable over some time horizon.

The third task would be to look at residuals relative to the ICA factors and to see if the can be modeled and are predictable.

Project 8 : Can Wavelets Enhance Prediction?

Use wavelets as a pre-filtering tool for analyzing time-series of prices/returns.

Is it possible to enhance prediction substantially using such techniques?

How can we utilize these types of filters to help detect dynamics on multiple time scales?

W wsould provide commodities time series and students could try and create trading strategies.

Have fun and feel free to contact us with any and all questions!