Short Interest projects:

Based on the paper by Mike Lipkin and Marco Avellaneda. They conjecture that the hard-to-borrow-ness of a stock can lead to a type of bubble dynamics. In particular, if a stock is hard-to-borrow, then there is a direct increase in the buy-in rate. A buy-in is an event where short holders are forced to cover their positions at market price. The authors propose a joint set of stochastic differential equations to account for this, where there is a positive feedback between the dynamics of the buy-in rate and the stock price.

Project 1:

Chinese stocks.

There are several examples of stocks that trade both in Hong Kong and in Shanghai. Those in HK can be shorted, whereas those in Shanghai cannot be shorted. There might also be some other regulatory differences between the two stock exchanges. The profile of the stocks on the different exchanges look quite different, and to the eye it seems that they exhibit the bubble effects implied from the L-A paper. In this project, students would try to calibrate the L-A model to the data and extract the model parameters from a direct comparison of these otherwise identical stocks, assuming that the degree of hard-to-borrow-ness is the only difference. This project would involve numerical simulation and calibration to data.

If it can indeed be shown that the model well describes the data in a significant fashion, then the results could be publishable. The goal would be then to write a paper (jointly with Mike Lipkin, EvA, Kay Giesecke and the students).

Project 2:

Short-interest data.

Is there a relationship between short interest and the buy in rate? One could back out the implied hard-to-borrow-ness from put call parity according to the L-A paper, and see how this correlates with short interest. Are any of these quantities predictable? Or can they be used to predict volatility or stock prices? Can one design option strategies, or “rebate-arbitrage” strategies?
Project 3:

Bubbles.

Intra-day signatures of hard-to-borrow-ness and bubbles. Look to see if rapid changes in price are accompanied by hard-to-borrow-ness. Look also on daily time-scales. In times of known bubbles, check to see if hard-to-borrowness (as can be implied from put-call parity or perhaps indicated from the short-interest data set) indeed increases and if it can “always” be linked to bubble-formation.

Statistical Arbitrage Projects:

Project 4.

Statistical arbitrage is a type of strategy where stock returns are separated into a systematic part and an idiosyncratic part. The goal is to try and predict the behavior of the idiosyncratic component, which often exhibits mean reversion. We base this project on a paper by Avellaneda and Lee. The first task is to replicate the Avellaneda paper (for a fixed PCA model) using a universe of stock returns that EvA can provide. We will also provide students with EvA’s own proprietary set of residuals, as well as a set of randomly generated data. (Note: we might not tell the students that one data set is random!)

There are several interesting questions here:

1) How well are the data actually described by an O-U process? Is there a better model?
2) How stationary are the O-U parameters?
3) Modify the threshold based rule to incorporate an optimal trading strategy similar to that in a paper by Boguslavsky and Boguslavskaya.
4) What are the statistical properties of the residuals?
5) What is the mean first passage time (i.e. excursion time) for the model? For EvA’s data?
6) What is the sensitivity on the “kappa” filter in the paper?
7) Better portfolio construction?

The main goal of this project will be to understand the statistical properties and dynamics of idiosyncratic residuals, and subsequently to come up with an attractive trading strategy.
Project 5.

Can you beat the trader?

EvA is occasionally contacted by external sources who claim to have fantastic trading strategies. Our challenge to the students is to come up with and explore approaches that might lead to enhanced predictability (and hence higher profit trading strategies).

EvA will provide a universe of stock return data, and/or time series of residual returns. The goal would be to utilize several of the following techniques:

1) wavelet filtering
2) kernel-smoothing (perhaps with fat-tailed kernel distribution)
3) try to predict returns
4) try to predict behavior of price process itself (first and second derivatives)
5) can you predict when the price is going to start trending upward/downward
6) do you see predictability on different time-horizons?

Project 6:

Exploring the structure of correlation:

Options on indices, as well as statistical arbitrage strategies crucially depend on correlation, which is very high-dimensional.

Given a set of intra-day price snapshots, what can one say about the structure and dynamics of correlations over different time-scales? For example, we know that volatility exhibits clustering on different time-scales, memory with a power-law decay across time-scales, and that there are certain well-understood properties of conditional volatility. Along these lines, what can be said for cross-stock correlations?

On a higher level, what are the dominant statistics of the evolution of correlation on different time scales? How can options on indices be projected onto these dominant statistics in a useful way? In other words, can one find a low-dimensional model for the evolution of the "shape" of the market?

Order-book Projects

Project 7:

Gerry and Kay propose creating a trade simulator. This will allow for testing of certain market-impact models.
Project 8:

Can the order book predict anything tradable?

Can we utilize information from the order book to predict subsequent price movements in stocks? For example, this project need not only look at tick-by tick order book data to predict returns over small time-scales, but could also look at an integrated order book profile to maybe predict over longer time-scales.