

Figure 1

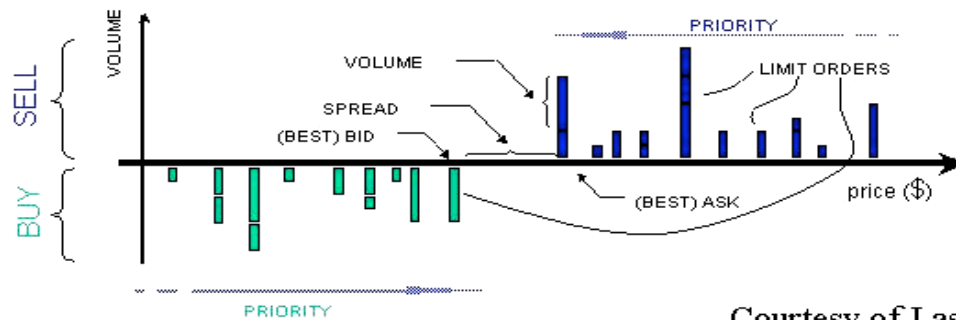
## The Limit Order Book: Revealed

**Limit Order:**

- Bid/Ask
- # of shares
- Execution time indefinite
- Limit Price

**Market Order:**

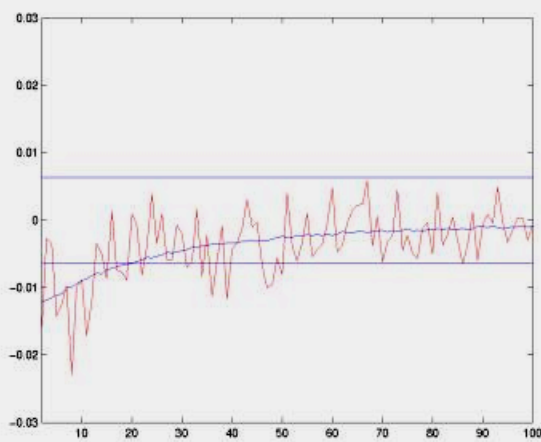
- Bid/Ask
- # of shares
- Executed immediately
- Price indeterminate



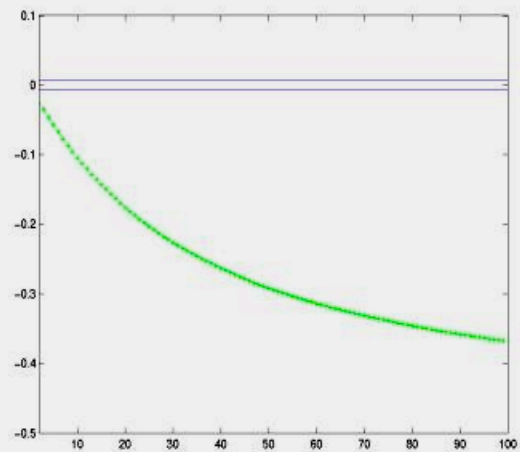
Courtesy of Laszlo Gillemot

**Figure 2**

## Limit Order Book with Random Order Flow



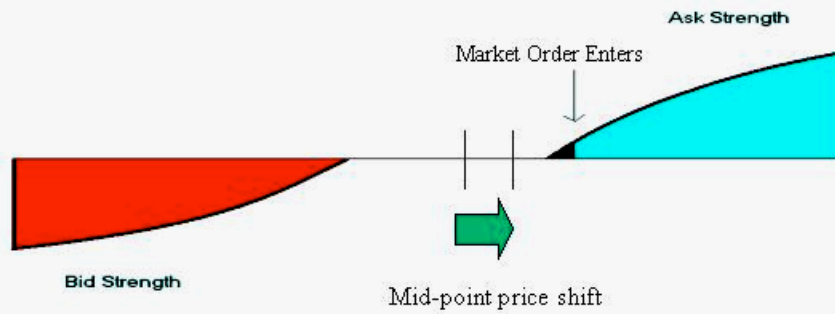
Average Autocorrelation over 1000 runs and unique autocorrelation for 1 run.



Sum of the Autocorrelation, measures maximum profits

**Figure 3**

## How the Negative Autocorrelation Happens...

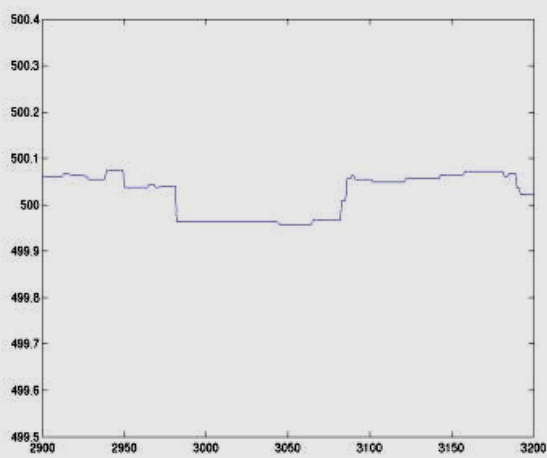


**Figure 4**

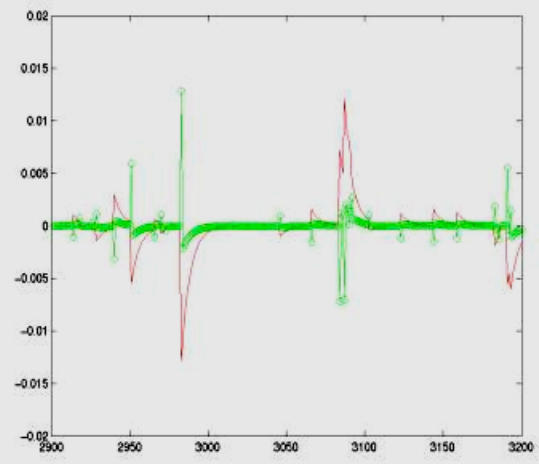
## Franky, Where's the Action?

**Exponential Moving Average:**

$$\text{Signal} = \text{past returns } (t-1) - (t-2) / \text{Tau} + (1 - 1/\text{Tau}) * \text{past signal}$$



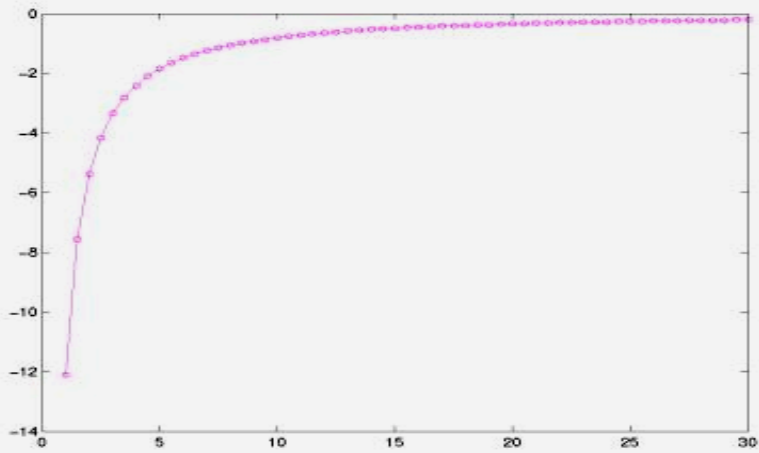
Example Price Movement



Signal, Position change results

**Figure 5**

# Profits over Tau: NO!



Mean Profits for 50 runs over  
Tau values

**Figure 6**

Spread Trigger Profits: No!

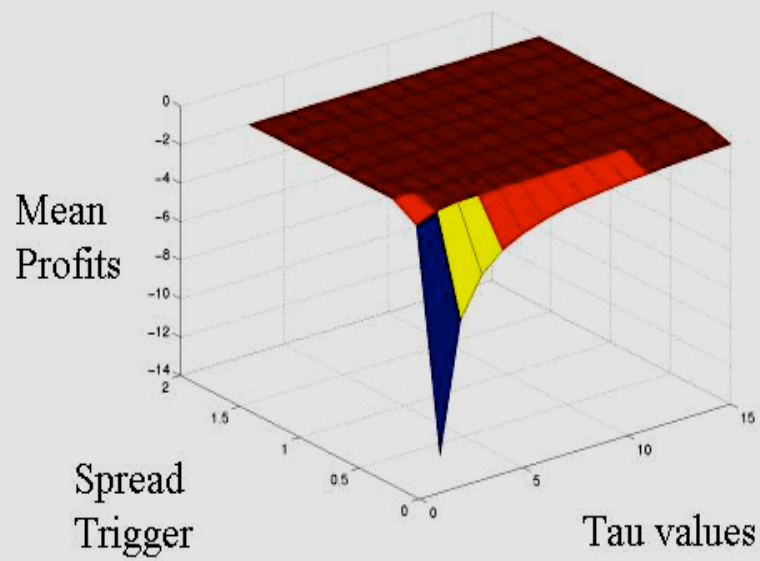
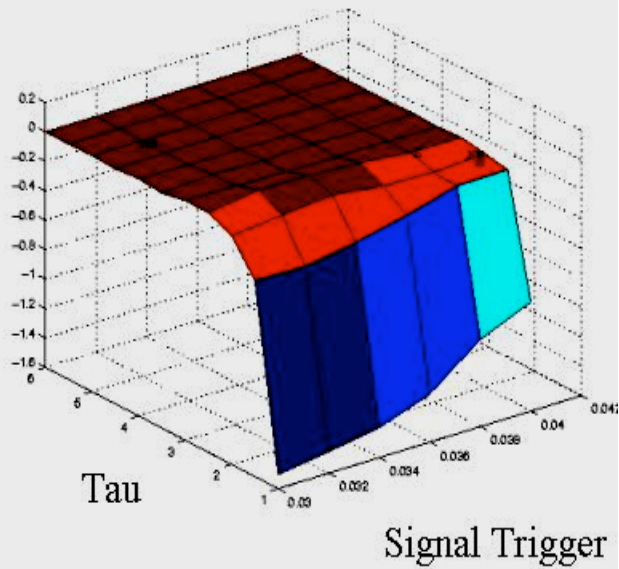
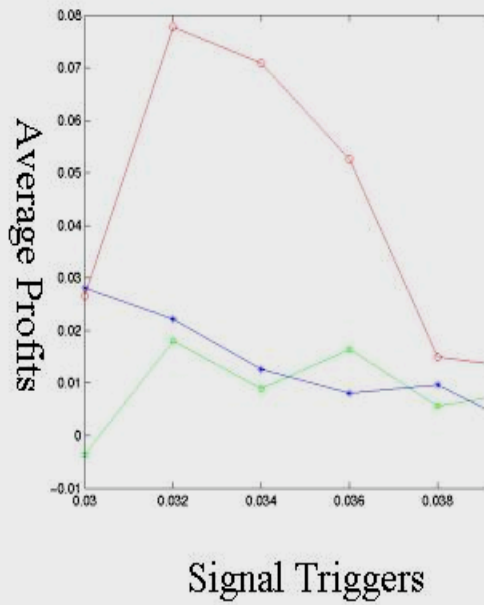


Figure 7

# Signal Trigger Profits: Occasionally!



## Appendix 1: Model Parameters

$\lambda = 1.0$  = limit order addition rate = # of shares /  $\Delta T$

$p_{\text{Bin}} = 1.0$  = width (in prices along the book) of limit order additions with uniform, Poisson distribution

# of shares =  $\lambda * p_{\text{Bin}} * \Delta T$

$\mu = 0.1$  = market order addition rate = # of shares /  $\Delta T$

$\gamma = 0.001$  = limit order expiration rate = # orders /  $\Delta T$

$\sigma = 1.0$  = typical order size, distributed with 1 standard deviation about 1

$\beta = 2 * \mu * \sigma / \lambda = 0.2$  = non-dimensionalized parameter